Airfield Research Group Ltd

ARG Research Note 12: RAF Fighter Command Operations Block / Cold War Bunker at Bentley Priory

Paul Francis, David Mountford and Richard Flagg – December 2010

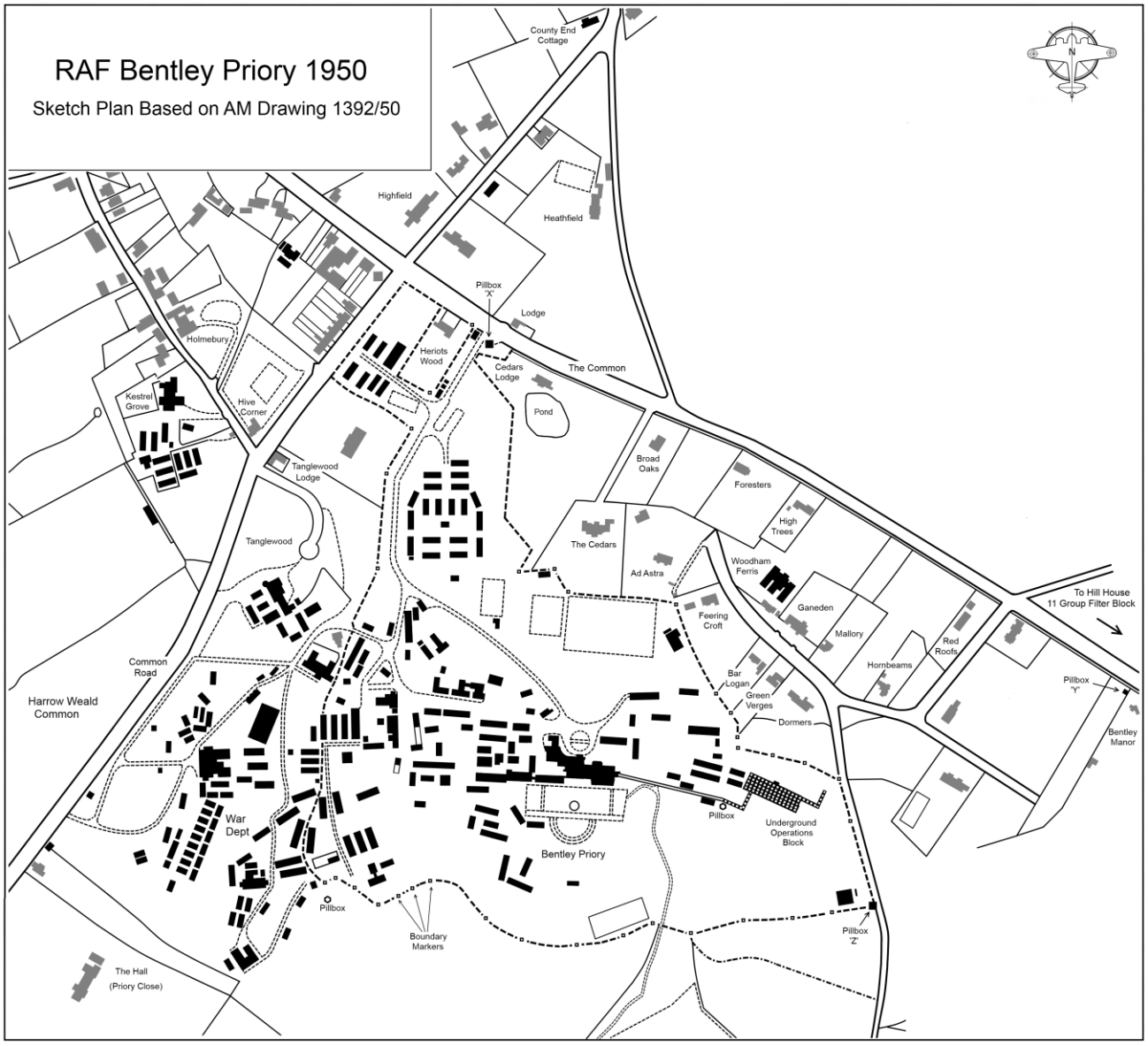

Plate 2: Site Plan 1950

Front Cover: The Operations Room c.1941. Photo: RAFM

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ACKNOWLEDGEMENTS

Colin Chatt, Graham Crisp, Colin Darby & John Hamlin

Plate 3: The upper gallery of the operations room, photo taken circa winter of 1939 / 1940. Photo: RAFM

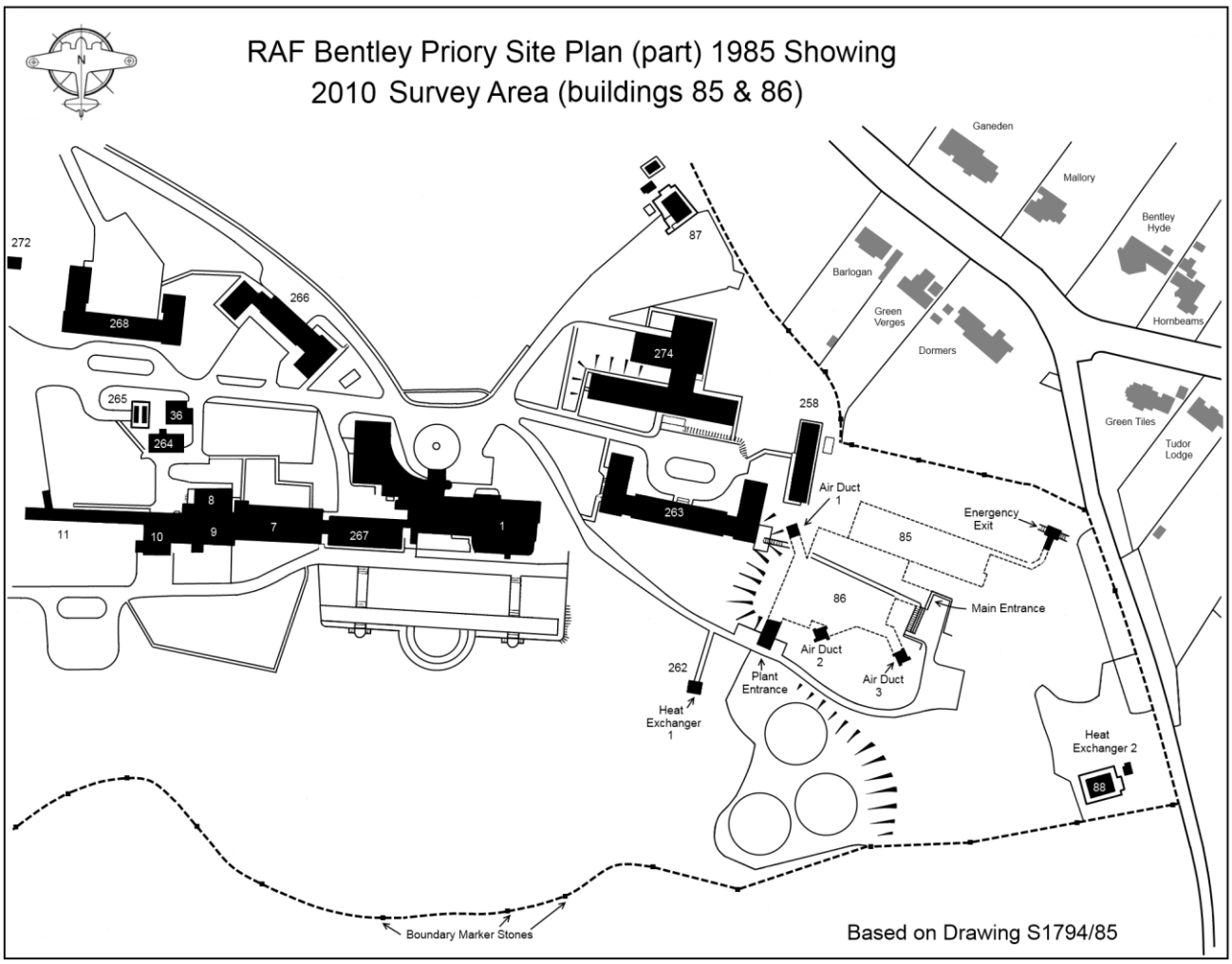

Plate 4: 1985 location plan

ABBREVIATIONS

ACM	Air Chief Marshall
ADC	Air Defence Commander
ADGB	Air Defence of Great Britain
ADOC	Air Defence Operations Centre
AEAF	Allied Expeditionary Air Force
AOC	Air Officer Commanding
AVM	Air Vice-Marshall
CH	Chain Home
CHEL	Chain Home Extra Low – detects aircraft as low as 100 feet high.
CHL	Chain Home Low –detecting aircraft 25 miles away at 500 feet
C-in-C	Commander-in-Chief
CTS	Controllers Training School
cu ft	cubic feet
cwt	hundredweight
DCAS	Deputy Chief of the Air Staff
DRW	Defence Radio Warfare
DTN	Defence Teleprinter Network
EMP	Electromagnetic Pulse (radiation resulting from a nuclear explosion)
EMS	Electromagnetic Spectrum
FC	Fighter Command
ft	feet (measurement)
CGI	Ground Controlled Interception (radar)
GPO	General Post Office
HDF	Home Defence Force
HF D/F	High Frequency Direction Finding
HQ FC	Headquarters Fighter Command
H&V	Heating and Ventilation
id	inside diameter
IFF	Identification, Friend or Foe
LAA	Light Anti-aircraft
m	metres (measurement)
mm	millimetre
QRA	Quick Reaction Alert
RDF	Radio Detection and Direction Finding
ROC	Royal Observer Corps
R / T	Radio Telephone
sq	square
UPS	Uninterruptible Power Supply
VF	Voice Frequency
WRAF	Women's Royal Air Force

Chapter 1: Methodology and Notes on Sources

1.1 The Report

This Level 4 report was commissioned by VSM Estates as a documentary research and building recording brief for Buildings 85 and 86, located on the Ordnance Survey kilometre grid square TQ 15 93. The buildings constitute the 1939 underground operations room and an underground Cold War extension to the 1939 structure.

Level 4 is described in the English Heritage publication, '*Understanding Historic Buildings a guide to good recording practice'* as follows:

> *Level 4 provides a comprehensive analytical record and is appropriate for buildings of special importance. Whereas Level 3 analysis and interpretation will clarify the building's history in so far as it may be deduced from the structure itself, the record at Level 4 will draw on the full range of available resources and discuss the building's significance in terms of architectural, social, regional or economic history. The range of drawings may also be greater than at other levels.*

The account has been completed to a minimum of English Heritage Level 4 standard, but subject to certain constraints regarding underground buildings; the report includes the Air Ministry purchase of part of the Bentley Priory Estate, and the development of the experimental operations and filter rooms inside Bentley Priory itself.

1.2 Methodology

A recording survey was carried out between 18–28 October 2010 by Airfield Research Group members Paul Francis, David Francis-Mountford (assisting) and Richard Flagg (photography). Graham Crisp carried out the proof-reading. A measured survey was carried out of the two underground structures and a 1:200 scale plan prepared. Another set of plans were prepared for the report, based on information at TNA and elsewhere, showing the 1939 internal arrangement of the original building. A full photographic survey was also carried by out by Richard Flagg and this is available on two DVDs which also contains all the drawing images.

1.3 Notes on Sources

Primary sources on RAF Bentley Priory are preserved in fairly small numbers and are part of a much larger collection of documents relating to the Royal Air Force in general, RAF Fighter Command, as well as squadron and station Operational Record Books (ORBs). These are mainly found in The National Archives (TNA) under the lettercode 'AIR'. There has been a considerable amount of confusion regarding these files, for two reasons:

- It is often the case that the name 'Bentley Priory' has been omitted and 'Stanmore' has been used instead for the same site when there was also an RAF Stanmore Park.
- Throughout many documents, it is not clear which buildings were occupied in relation to certain units where the names Stanmore and Bentley Priory have been used. At the end of WWII there were over 208 buildings at Bentley Priory and the files are not specific enough to isolate a particular hut or building. Furthermore there were over 60 requisitioned properties in the local area.

Unfortunately there were very few records found relating to the ‘as-built’ 1939 underground building apart from details of its construction. There is very little on the WWII operational aspect, although the period 1953 to 1970 is fairly well covered. There are no files in the TNA of the period covering the extensions (1982 to date). Almost certainly documents will exist which are within the ‘30 year rule’. Finally, there are very few WWII or immediate post-war photographs available of the inside of the underground structure.

The primary source for the Cold War extensions is in the form of a few original plans, 1:100 and 1:200 scale drawings found in Building 10 at Bentley Priory; which are mainly dated 1981, 1982 and 1995. From these it was possible to work out the function of most of the rooms. No pre-war architectural general arrangement drawings were found, apart from a plant drawing and a sketch, dated 1939.

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Plate 5: Operations Room inside Bentley Priory circa February 1940. Photo: RAFM

Chapter 2: Bentley Priory 1926 to 1939

2.1 Site Purchase

As from 1 April 1926, the Home Defence Force, (HDF) became entirely reorganised and separated from the command organisation known as 'Inland Area'. Fighting Area had formed as the organisation to control RAF fighter squadrons that originally had been a function of Inland Area, but on its reorganisation, Fighting Area transferred to a new organisation known as Air Defence of Great Britain (ADGB). In July 1926, Fighting Area moved from Kenley to Hillingdon House, Uxbridge, which had been the headquarters of Inland Area since April 1920. As Hillingdon House was going to be the permanent headquarters for both ADGB and Fighting Area, it became necessary to find another HQ location for the reorganised Inland Area. The establishment of the 'new' Inland Area had also been reduced (as two[1] of its functions had been removed), from 43 officers, 118 airmen and 20 civilians to 34 officers, 38 airmen plus 74 civilians. In its new role Inland Area controlled three groups:

- 21 Group at West Drayton, controlling the stores and repair depots
- 22 Group, Farnborough, running the Army Co-operation units
- 23 Group controlling the Flying Training Schools.

In deciding on the location of a new headquarters, the following factors were taken into account:

- Its location had preferably to be on the outskirts of London in order to be near the Air Ministry
- The HQ had to be centrally located in relation to the formations and units in its command
- It had to be close to the headquarters of the HDF
- The HQ had to be within two or three miles of a service aerodrome.

Options for the location for a headquarters included Canons Park, Edgware and the Country Club, Hendon. All of these sites were within two miles of the aerodrome at Hendon, which the Air Ministry was also considering purchasing. The most suitable site however, was Bentley Priory, Stanmore, a large mansion situated in the parishes of Harrow Weald and Stanmore, Middlesex, which was located on the main Watford–Stanmore road.[2] At five miles, it was outside the two to three mile limit of being close to a service aerodrome, but it was well served with omnibuses, running between Watford and Edgware underground station (142A), and Watford and Kilburn Park station (142B).

[1] The other was Wessex Bombing Area
[2] 25" OS Map Herts, Sheet XLIV. 12, Middlesex Sheet V. 12, Herts, Sheet XLIV.11, Middlesex Sheet V.11 & 6" OS Map Middlesex Sheet V.SE

2.2 Description of the Great House

The estate and great house was described in exceptional detail in a report (the author is unknown but contains notes by Air Commodore Webb-Brown), dated c.1926 for the Air Ministry; amongst a great deal more, it contained the following.[3]

The house is reached by two 16 ft wide gravelled carriage drives which terminate at the main entrance of the house on the north front. The entrances to these drives are guarded by lodges, the eastern-most of which is a one-storey building in Tudor style with thatched roof and ornamental bargeboards of pleasing design; the other is a very plain two-storey building in Tudor style with stucco walls and slate roof, the latter has two rooms, scullery and earth closet on the ground floor and two bedrooms on the first floor.

The main building of three floors and basement, is of imposing appearance and well built and standing in an elevated position about 468 ordnance datum (OD). Its south front commands a splendid view over the surrounding country towards Harrow-on-the-Hill. The buildings appear to be of three ages. The oldest portion, which forms the major part of the main block, was erected in the last two decades of the 18th Century, its design being that of the Renaissance period. Incidentally there is a monument in the grounds to a daughter deceased dated 1801 which I was informed, was erected whilst the mansion was in occupation and which helps to fix its date.

Some years ago it ceased to be used as a private residence and became an hotel; it has been occupied in later years as a Girls' Boarding School, during which time alterations have taken place and wings have been added to provide further accommodation. To the west and adjoining the main building is a conservatory or winter garden with glazed roof, while the east annexe is a single-storey building which has been used as classrooms and sleeping quarters. Extending to the north from here is a music room and two-storey servants' quarters, to which has been added an engine and battery-charging room. A central block is a gymnasium and changing room that separates the east from the west annexe. A sanatorium wing extends north and forms one side of a kitchen garden. The terraced garden is bounded by a brick retaining wall with panels of knapped flint. Situated within farm buildings arranged around a yard is a garage and accommodation for a chauffeur. To the south of the farm buildings is a sunken grass plot 132 feet square which may have originally been a bowling green.

The existing buildings would provide sufficient accommodation for the requirements both for HQ offices and quarters for personnel. The exact establishment to be provided is not available at present, but floor area compares with that of Hillingdon House (Uxbridge) as follows:

- *Bentley Priory main building 15,928 sq ft*
- *Hillingdon House main building 14,289 sq ft.*

[3] AIR 2/277

The proposed adaption of existing buildings was as follows:

- Main building and winter garden as HQ offices and mess
- East annexe as officers' quarters
- West annexe as airmen's quarters
- Sanatorium block as sergeants' quarters
- Farm buildings as quarters for transport personnel
- Servants' quarters to remain as such
- West Lodge as 'B' type married quarter.

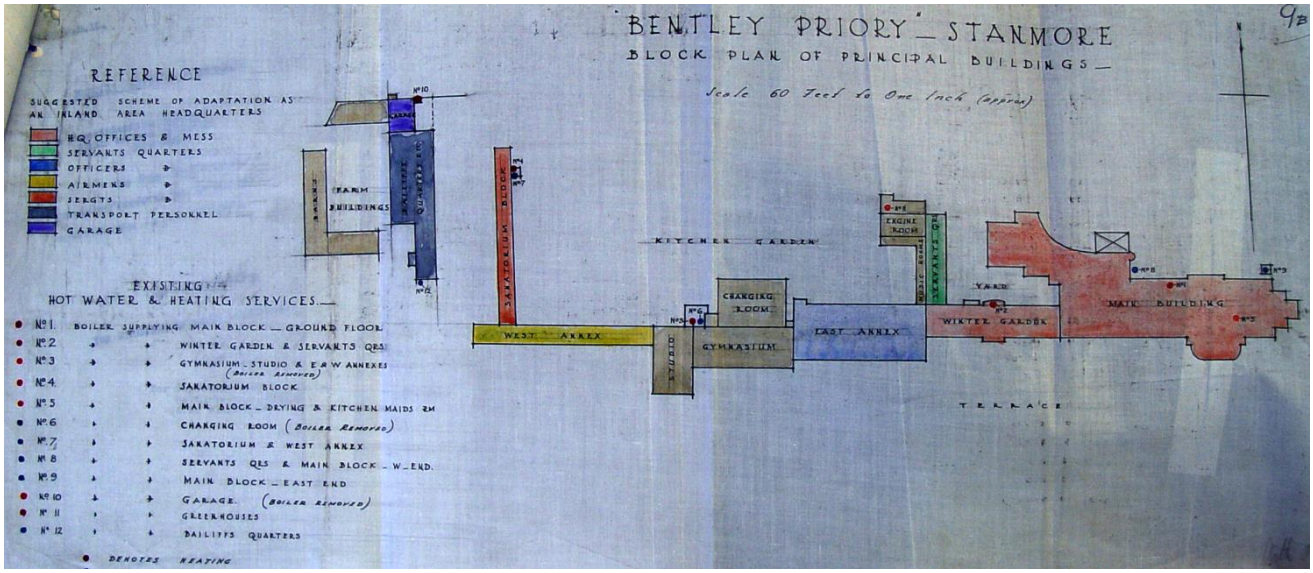


Plate 6: An early plan of Bentley Priory at the time of the sale to the Air Ministry. (AIR 2/277)

Contracts were exchanged with Stanmore Estates Ltd on 25 March 1926, the purchase price being paid by two banker's drafts, one for £13,543 1 10d made payable to the vendor's solicitors (Neish, Howell and Haldane), and the other £11,468 12 8d, made payable to The Clerical Medical and General Life Assurance Society. The freehold of Bentley Priory consisted of 41 acres, outbuildings and Bushy Lodge.

In addition to the purchase price, a programme of works services was required to the historic house totalling £12,000 (a reduction of £3,000 from the original estimate), and the Treasury provided funds for this in the 1926 Estimates under item 60, subhead 'B', Vote 4. It was also proposed to provide married quarters by acquisition of houses in the locality and the following properties were selected, with their valuations:

- 1 Group II quarter '*Woodcote*', Stone Grove, Edgware – £4,150 plus £350 works expenditure
- 1 Group II quarter '*The Garth'*, Stanmore – £2,500 plus works service of £200
- 1 Group IV quarter at Penshurst Gardens, Stanmore – £2,200 plus £75 works expenditure
- 2 Group IV quarters consisting of a pair of semi-detached houses at Hillside Drive, Edgware– £3,000 plus £150 works expenditure.

The only other officer's married quarter remaining to be provided for in addition to the above was the residence for the Air Officer Commanding, but a suitable property had yet to be found.

Quarters for married airmen and recreational facilities for all ranks, estimated to cost £5,200 and £500 respectively were put on charge against the *Part 1, general items under Subhead 'B', Vote 4,* in the 1926 Air Estimates.

Despite the acquisition of all of the above resulting in a considerable saving in the cost of erection of new married quarters, not everyone was happy about the purchases, and the following questions were asked in Parliament:

> SIR F HALL *asked for what purpose the Ministry are arranging to buy Bentley Priory, Stanmore, for the use of the Royal Air Force; how the purpose is now met; and what is the total cost involved in the scheme?*
>
> Sir P Sassoon*: As regards the first part of the question, Bentley Priory is being purchased for use as headquarters of the reorganised Inland Area, Royal Air Force, which is to form in April next. As regards the second part, the existing Inland Area headquarters are at Hillingdon House, Uxbridge, and this accommodation, when vacated, will be used for the Fighting Area headquarters of the Home Defence Force, which is part of the approved Home Defence expansion scheme. As regards the last part of the question, the total cost involved in the acquisition and adaptation of Bentley Priory will be approximately £40,000. I may add that the purchase and adaptation of these premises is the most economical method of providing the accommodation required for these headquarters; to purchase a site and erect new buildings thereon would entail a much heavier outlay.*
>
> Sir F Wise: *What is the acreage?*
>
> Sir P Sassoon: *I think it is 41 acres*.

As soon as the Air Ministry had acquired the property, concrete boundary marker stones were erected at points where there was a change in direction of the boundary line (Many of these are extant, but are now located on the other side of the current fence line).

Plate 7: The operations room inside Bentley Priory during the winter of 1939 / 1940 – view of the upper gallery. Photo: RAFM

Chapter 3: Air Defence of Great Britain / Fighter Command

3.1 Air Defence of Great Britain 1926 to 1936

The air defence system that had been created between 1915 and 1918 had all but completely disappeared by the end of 1920, and in the absence of any air threat to the country there was little inclination by the Government of the day to build another.

Then on 9 January 1923 the Reparations Commission declared Germany in default on deliveries of coal, and as a result the new Government of Prime Minister, Raymond Poincare, in an attempt to enforce the payment, sent in troops across the Rhine to occupy the Ruhr basin. The French Rhineland Army supported by 20 squadrons was as large as the German Army.[4] The British Government made no attempt to intervene; the British Zone of occupation in the Rhineland lay between the French Zone and the Ruhr, but French troop trains were permitted to cross it.[5] The British Government, alarmed at a possible clash with the French over the Ruhr, decided that a Home Defence Air Force of sufficient strength was required to protect against an air attack by the strongest air force (the Armée de l'Air) within striking distance of this country. The Cabinet therefore approved an expansion scheme to increase the strength of the RAF to that of the nearest potential enemy. Prime Minister Baldwin (he had just replaced Bonar Law as PM) therefore, announced in Parliament on 20 June 1923, that the strength of the RAF would now be increased to 52 fighter and bomber squadrons.

Germany returned to the international stage with the signing of the Treaty of Locarno in London on 1 December 1925.[6] By this treaty Belgium, the eastern frontiers of France, and the western frontiers of Germany, were guaranteed against German or French invasion by the Governments of Great Britain, Italy, France, Germany and Belgium.[7] Germany was admitted to The League of Nations. With the ratification of the Treaty of Locarno which led to the withdrawal of the French Rhineland Army from the Ruhr basin and the first zone of the Rhineland, the allied evacuation of this area was completed by 1 February 1926. Against this international background at home, doubts were expressed at Cabinet level over the cost and justification for completing the 52–Squadron scheme. Lord Birkenhead's Committee on Air Force Expansion for Home Defence convened on 11 November 1925 to look at the future of the expansion programme now that a secure peace had been established in Europe.

The committee had decided on deceleration with the result that it was announced in Parliament on 25 February 1926 that completion of the 52–squadron scheme was to be postponed until 1935.

While the expansion of the RAF over the period 1923–34 was slow, considerable progress was made during the first ten years, so that by the end of 1929 a force of 38 bomber and fighter squadrons had been formed at home. At this time, the foundations of an air defence system was

[4] Hooton, p.38-39
[5] Mowat, p.158
[6] Taylor, p.221 puts the date as 1 December but Hirst suggests it was 16 October.
[7] Hirst, p.61

laid, the meaning of ‘air defence’ was defined and the principles that would govern air defence operations had been agreed upon by the services concerned. The Air Ministry became the authority responsible for the air defence of the country.

A new command was formed which was to be responsible for the Home Defence forces and this was termed Air Defence of Great Britain (ADGB). The first AOC-in-C was Air Marshall Sir John Salmond, who was appointed in early 1925, although he did not take control until 1 June 1926, when ADGB headquarters opened at Hillingdon House, Uxbridge.

At this time the RAF at home was divided into four Areas – Wessex Bombing, Fighting and Inland.

Inland Area remained in control of all Auxiliary Air Force and Special Reserve squadrons for a short time. These would have been required for the defence of the country in the event of war and so in January 1927 they were transferred to ADGB and became 1 Air Defence Group. No changes occurred to Fighting Area until it became 11 Fighter Group on 1 May 1936, shortly before the formation of Fighter Command.

Investigations were carried out in 1926/7 to find the best method of deploying the fighter squadrons. The chosen idea was to form a defence zone into which the enemy must pass to reach important targets and where the fighters could give battle under conditions more favourable to them. This meant that the fighters had to have sufficient warning to enable them to reach their fighting height before the enemy had flown through the zone. This became known as the Air Fighting Zone, which would form a barrier between aircraft coming from the direction of the Channel on their flight path to targets in London and the Midlands. It was divided into ten sectors each of which was fifteen miles square. The four sectors covering London were each manned by two squadrons, the others by one. In addition three squadrons were divided between Tangmere and Hawkinge, designed to harass the enemy, taking them away from their targets. London itself was to be defended by an inner ring of searchlights and guns within what was called an Inner Artillery Zone. The project was never fully completed – there were never more than 13 fighter squadrons in ADGB and the number of anti-aircraft units expanded at an even slower rate than that of the fighters. Between 1927 and 1935 the system was tested by quite a number of air annual exercises which, as a whole, clearly demonstrated that the air-defence system was woefully inadequate. ADGB up until 1934 had assumed that the likely enemy was France and the main focus of operations had been the English Channel. Within a few months of the rise of Germany the position of the RAF had completely changed to that of being in allegiance with France against Germany. It also followed that the RAF must lay plans for operations from continental bases and for the reorientation of the air defence system in order to meet the potential threat from Germany. The plan for reorientation was drawn up in the last months of 1934, by a committee under the chairmanship of Sir Robert Brooke Popham, the AOC-in-C of ADGB.

In the likelihood of continental operations, four fighter squadrons became ‘mobile’ squadrons for the Expeditionary Force and another five for what became Advanced Air Defences. These would be established in Belgium, in the event of war arising out of a breach of the Locarno agreement.

The main task of the mobile squadrons was to act as advanced defences of London and the south-east. The system of control at home remained the same except that Fighting Area was split into northern and southern sections (similar to the later division of 11 and 12 Groups).

Towards the end of 1936 investigations were put in hand to find the 'ideal' air defence scheme which would be an insurance against an attempt by the German Air Force at a 'knockout blow'. While this was under investigation the success of RDF had been practically assured and this immediately produced important changes to the sector arrangement. Prior to 1936 the location of the sectors had been based on the distance between the coast and the Air Fighting Zone. With the aid of RDF, it was hoped that warning of the enemy's approach would be obtained in sufficient time to permit interception near the coast. As a result the forward boundaries were advanced to the coast instead of terminating some distance inland as before.

Another scientific development which made for increased efficiency in defence, and which had been introduced into all sectors between 1937 and 1939, was HF D/F which was used as a navigational aid and for facilitating the control of fighters on the ground.

3.2 Fighter Command 1936 to September 1939

Meanwhile the Air Ministry had been working out the organisation of the RAF at home. On 1 May 1936 Inland Area and Coastal Area were elevated to command level (Inland Command, was soon changed to Training Command), and the term 'Area' was abolished with Fighting Area becoming 11 Group. Two months later headquarters Training Command moved from Bentley Priory to Buntingsdale Hall, Shropshire and on 14 July headquarters ADGB ceased to exist, being replaced by two operational commands, Bomber Command (Hillingdon House) and Fighter Command (Bentley Priory), each under a Commander-in-Chief who reported to the Air Ministry.

When it formed Fighter Command contained only two subsidiary air defence organisations, the Observer Corps and HQ 11 Group, which previously had been ADGB Fighting Area and so contained all the regular squadrons of the Metropolitan Air Force. As more squadrons were formed under the subsequent expansion schemes of 1936–39, further fighter groups were formed and added to the strength of the command. The first new one was 12 Group whose headquarters were at Hucknall. By July there were thirty squadrons in the command – twenty-three in 11 Group and seven in 12 Group.

Under the 'ideal' scheme the air defence system was extended north to Northumberland, and west towards Bristol. It was also decided to increase the number of sectors from eleven to fifteen and to form a new group (13 Group) to take over responsibility for defence north of the Humber. The new sectors were Turnhouse, Kirton-in-Lindsey, Swanton Morley (later changed to Coltishall) and Filton (later changed to Colerne).

By the beginning of 1938 the planned air defence scheme practically covered the whole of the eastern half of the country from Edinburgh to Portsmouth with a chain of sector stations and searchlight companies – this being based on the assumption that attacks would be made across

the east and south-east coasts. But as bomber performance increased there arose another problem, that of the danger of outflanking attacks. If Germany was prepared to violate the neutrality of the Low Countries it would be possible for bombers to take-off from Germany, fly down the channel and turn towards the Midlands which would be beyond the range of RAF fighters. This assumption would require a further extension beyond that planned in the 'ideal' scheme. It was therefore decided to extend the searchlight zone from Bristol northwards into Lancashire. No additional fighter strength was proposed at this stage but 'back area' three sector stations were to be established at Elmdon, Sealand, and Ternhill, which would be used by 12 Group squadrons should the situation arise.

As 1938 passed into 1939, with no slackening of the international situation, it was decided to form another fighter group (10 Group) for the control of defensive operations to the west of Portsmouth. At that time (May), only two sector stations were planned for that part of the country and very little was actually done towards establishing the necessary buildings and communications until the first months of 1940.

Plate 8: A wartime or immediate post-war image of Bentley Priory looking north. Photo: RAFM

3.3 Air Estimates

With regards to funding projects at headquarters Fighter Command it is not possible to isolate the exact costs allocated in the Air Estimates for the various construction projects at Bentley Priory or of the underground block; this particular project is hidden amongst other projects under a '*general item 148'*.

The Treasury had sanctioned the construction of the underground operations room on 23 September 1938 (letter S,43653), and a suitable site had already been selected within the existing Air Ministry boundary. It would also include two stand-by set buildings and ancillary services such

as underground cables etc at an estimated cost of £45,000. This was to be a charge to the *general item 148 in Subhead 'B' of Air Vote 4 P938* under the heading 'Command and Group Headquarters'. This heading in the Air Estimates for 1938 must have applied to all RAF command and group headquarters as the estimated figure of £900,000 was to be allocated, the probable expenditure up to 31 March (the date of publication of the estimates) was nil and the amount to be voted for in 1938 was £40,000. In the following year the estimated figure had increased to a staggering £2M – the probable expenditure to be spent before 31 March 1939 had increased from nil to £95,000. In addition £280,000 was to be voted for in 1939, and another £1,625,000 was required to complete the projects.

In the 1938 Air Estimates, *Part 1, item 8 (Bentley Priory) in Subhead 'B',* the approved figure of just £11,500 was all that had been allocated for new works titled '*additional accommodation for a command headquarters*'. It is understood that this money was actually for a new sergeants' mess and quarters plus the remodelling of a warrant officers' and two airmen's quarters which were to be converted into barracks – there is no mention of an underground building and actually those projects may never had been completed before the outbreak of WWII!

The following year authority was given (*S.40700 TISC 181/11*), to the purchase for the requirements of a new command, which was yet to be formed called Anti-Aircraft Command. It involved an adjoining property known as '*Glenthorne*', consisting of a house and 16 acres of land for £17,000, bought from the owner Mr FG Lawes. This purchase required additional works services including expenditure of £3,000 for a small hutted camp and a new road access between Glenthorne and Bentley Priory. The funding for these works schemes was sanctioned through the *Part 1, item 8 (Bentley Priory)* figure (originally for the new sergeants' mess etc) which had to be increased from £11,500 to £21,500 in order to cover the additional costs.

Meanwhile RAF Fighter Command had proposed to erect a second storey to an existing building at Bentley Priory, but it was found to be structurally unsound. As a result it was proposed to demolish the Winter Gardens and to erect on this site a new two-storey office building, which was designed to permit the addition of a third storey if necessary. The cost of the two-storey phase came to £5,500, but then came outbreak of WWII and the project was deferred. The Winter Gardens were demolished and a timber hut was erected on the site instead, which survived until c.1957 when it was replaced by a three-storey building.

Chapter 4: Fighter Command HQ Operations Room and Filter Rooms

4.1 Experimental Operations Room

4.1.1 Pre WWII Function for June 1938

This is the situation before Filter Room No.3 existed.

The function of the experimental HQ FC operations room was different from that at group level (the old Fighting Area experimental operations room at Hillingdon House, Uxbridge) whose function was to assist the 11 Group AOC in his task of intercepting raids (strategic control) for which he was responsible. He was able to do this through the sector operations room which had tactical control of the battle in the air.

The HQ FC operations room was in use during the Home Defence Exercises and functioned to enable recognition of friendly aircraft; it also provided information to the organisations concerned with anti-aircraft ground defences and air raid warning. Another task was to allot hostile raids to fighter groups in case any doubt exited as to which group was responsible for intercepting certain raids. A further responsibility was to arrange reinforcement of groups which may have been overloaded. Information on incoming tracks was to be received from Filter Room No.2 (at Bawdsey), from observer centres, and from other sources; this data was plotted by means of arrows on a map table. The colour of the head of the arrow was changed every five minutes according to the operations colour change clock. Outside the recognition zone, which is drawn on the map about 50 miles from the coast, unknown tracks were plotted with yellow-tailed arrows. If the track was then recognised as a friend, a red-tailed arrow was used and when it was unrecognised at a recognition line, the track was assumed to be hostile and was plotted thereafter with a blue-tailed arrow.

Admiralty, bomber and coastal liaison officers also watched the table and indicated any tracks that they recognised as their own. An officer estimated the speed and future track of enemy raids and passed this information on to the air-raid warning organisation for distribution via telephone.[8]

4.1.2 Design and Construction

The question of a permanent HQ FC operations room was discussed at a conference held on 10 June 1936, under the chairmanship of the Chief of the Air Staff (CAS). Prior to this the C-in-C Fighter Command had given consideration to the detailed requirement and on 2 July sought approval for the expenditure of £500 chargeable to *Vote 4, Sub-head K36*. The first proposal was to produce an experimental map table and platform, in the conference room at Bentley Priory, together with partitions in the adjoining library which would form the teleprinter room and offices for the meteorological and observer corps officers. The details of the works were drawn up as plans FCW/2 and FCW/14, which were prepared by the Directorate of Works engineer. The

[8] Supplement to the London Gazette 11-09-46

necessary work was carried out under the auspices of the Superintending Engineer, No.8 Works Area, West Drayton.

This money was approved on 23 July 1936. As far as a permanent building was concerned, very little was done on the subject until January 1938, because the C-in-C would not consider requirements of the command operations room beyond 11 (Fighter) Group, and he wanted to wait until after the 1938 exercises before submitting any recommendations.

Meanwhile experiments taking place in the conference room at Bentley Priory were making progress but these were limited to the requirements of 11 Fighter Group. This room was found to be the most suitable one to house the experimental operations room which consisted of the map table (an irregular pentagon) surrounded on three sides by staging and above this was a 7ft high dais which was accessed from two staircases located at each end.

Plate 9: Operations Room, Bentley Priory circa February 1940. Photo: RAFM

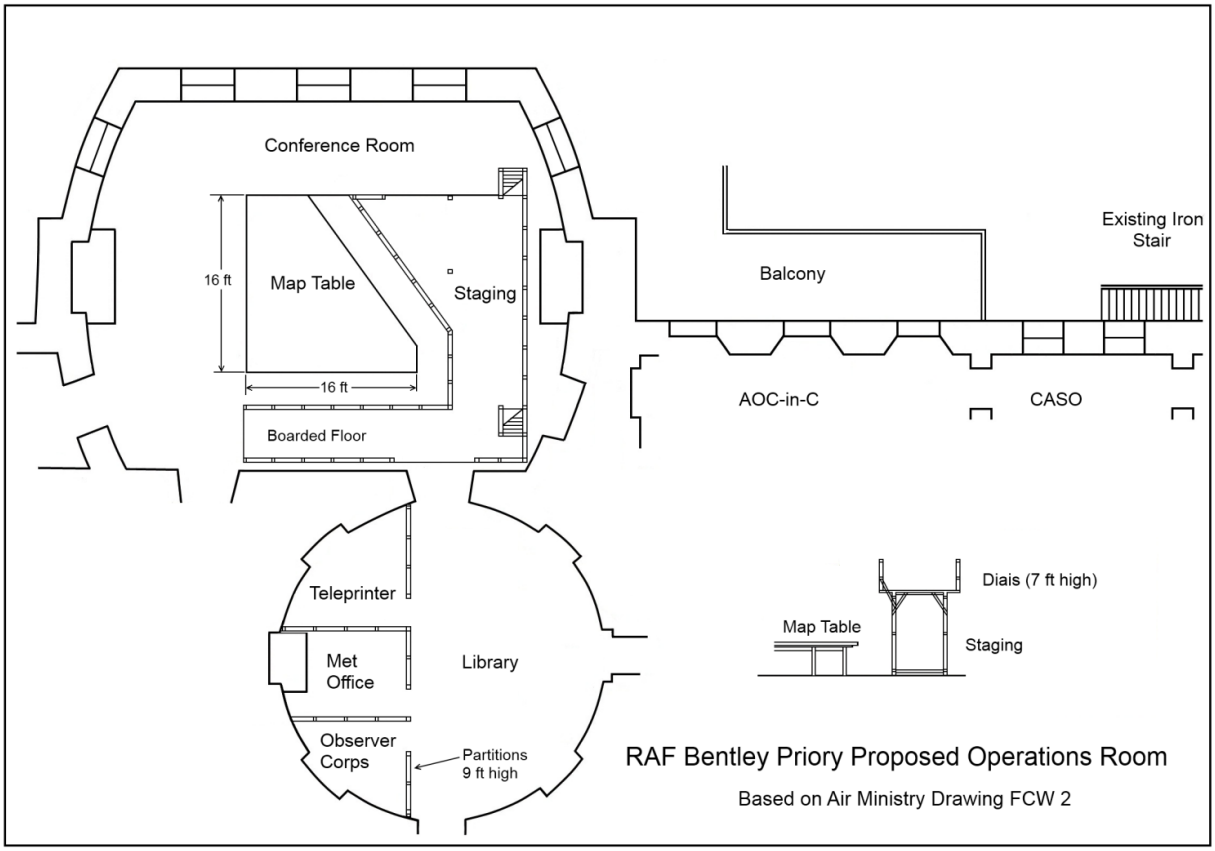


Plate 10: drawing based on FCW/2

Plate 11: Controller's position, Bentley Priory operations room circa February 1940. Photo: RAFM

Plate 12: Another view of the Bentley Priory operations room circa February 1940. Photo: RAFM

4.2 Underground Operations Room (1940)

From August 1940, the whole of the United Kingdom had been divided into six fighter groups (Nos. 9 to 14), which come under HQ FC. These were themselves subdivided into sectors; each sector had under its control, a number of aerodromes, one of which was the sector itself. Large-scale policy on air battles was dictated by the duty Air Staff Officer at Fighter Command. Subject to his orders the group controllers had the job of allocating enemy raids to suitable sectors, plus a suitable number of aircraft at each sector. Sector controllers directed the fighters that they had been allocated by means of radio (R/T) in an effort to intercept the particular raid with which they were concerned.[9]

Each group and sector had an operations table roughly similar to the one at HQ FC, but covering an appropriately smaller geographical area. The British Isles and neighbouring seas were covered by an imaginary grid which was used for plotting purposes. Each square represented one square kilometre and was identified by a grid reference of a letter plus four digits. Plots, from which tracks were built up, were received from RDF stations which arrived at the filter room (Room 6) table and after surplus information had been removed, tracks were passed by telephone simultaneously to the operations room (Room 5) and to the group tables.

[9] AIR 16/1507

The system evolved where command was responsible for the identification of approaching formations and for the allotment of enemy raids to groups where any doubt existed. Group Commanders decided which sector should meet any specified raid and the strength of the fighter force which would have been deployed to meet that threat. Sector Commanders detailed the fighter units to make the interception of the enemy aircraft. The Sector Commander was able to follow the progress of the battle on his operations table; he could see the positions and courses of the enemy formations and of his own fighters. He was also able to direct the latter as to make interceptions with the enemy. He could do this by giving orders to fighter pilots by meant of simple code such as '*Vector 230'* (fly on a course of 230 degrees). However the enemy soon learned the code, so a false quantity was introduced into certain signals such as '*Angels 18'* (which originally meant fly at 18,000 feet), now meant fly at 21,000 feet!

4.3 Air Raid Warning System

The Air Raid Warning System was developed by the Home Office and Air Vice Marshall AD Cunningham. It operated centrally from the underground operations block (with a small exception in the Orkneys and Shetlands). The country was divided into about 130 'Warning Districts', the boundaries of which were determined by the lay-out of the public telephone system. These districts were shown on the main map in the operations room, and the tracks of all enemy raids, whether over the land or sea were plotted by means of counters deposited and removed as required by a number of plotters. These counter were of three colours, according to the five-minute period in which they were placed on the table. This was necessary to allow removal at the end of 15 minutes and hence obviate confusion caused by 'stale plots'.

Three telephone operators were in continuous communication with the trunk exchanges in London, Liverpool and Glasgow, and when a raid was within 20 minutes flying distance of a warning district the Air Raid Warning would send a message, for example '*10 Norwich Yellow'.* The London operator would immediately retransmit this to the London trunk exchange, and the London operator would in turn relay this message to the Norwich Warning District. This was a preliminary caution for the information of police and fire service etc and was not a public warning.

About five minutes later, if Norwich was still under threat, then a Red Warning would be given – this was the signal for the siren to be sounded. A Green Signal indicated Raiders passed and the siren then sounded the 'All Clear'. A Purple Warning was introduced as the signal for the extinction of exposed lights, mainly used for factories and docks.[10]

After decentralisation (completed by September 1941), the Air-Raid Warning (ARW) system at HQ FC only covered the 11 Group area, the other FC groups taking over ARW for their area.

[10] Supplement to the London Gazette 11-09-46

4.4 Nos. 3 and 4 Filter Rooms at Bentley Priory

4.4.1 Background

As it was impractical to keep fighter aircraft continuously in the air to carry out round the clock coastal patrols, so a means of detecting aircraft many miles out to sea was necessary, and this had to work in all weathers, day and night. The answer to this requirement was Radio Detection and Direction Finding (RDF)[11] which had been included into the pre-war Fighter Command defence scheme although on an experimental basis, and located at the experimental research station at Bawdsey. The RDF stations made up the reporting and interception chains which cooperated with air operations staff of HQ FC. It was essential that HQ FC had to have early warning of all aircraft approaching the UK, if any fighter action was to be taken. Since Easter 1939, the RDF organisation had been maintaining a 24–hour continuous watch on around 60% of its stations by putting stations on watch alternatively; this took account of stations becoming unserviceable, carrying out maintenance, or for modifications.

The first three RDF stations, which were planned to be erected from June 1936, were a transmitting station at Orfordness (using the research equipment already installed, but with the addition of two 250 feet high guyed masts) and two transmitting / receiving stations at Bawdsey and Great Bromley. The five stations for service trials,[12] erected from August were three transmitting / receiving stations at Bawdsey, Canewdon and Dover, plus Great Bromley and Dunkirk as transmitting stations. Canewdon and Dover were in fact delayed until after September, thus delaying the Home Defence Exercises for that year.

4.4.2 Filter Rooms Nos. 1 and 2 (Bawdsey Manor)

The Bawdsey Research Station had been responsible for all experimental work in connection with operations covering the use of RDF, including filter development. The first experimental filter room was installed there in July 1937; its main feature was a map-table covering the approaches to the Thames Estuary. On this were plotted reports of aircraft positions as received by telephone from RDF stations at Bawdsey, Canewdon and Dover. This data was at first in the form of readings of range and bearing, but as this method proved too complicated for the filter room, the next RDF experiment took a step back and involved the stations reporting the map–grid coordinates of aircraft positions, calculated from their readings of range and bearing. In the filter room the reports received were plotted on the map table by means of counters that were coloured to correspond with the coloured ten-minute segments of the filter room clock (the ten-minute segments were later reduced to five-minutes to prevent the map table from being too congested). By the end of November 1937 the tracks obtained from filtering were being passed by telephone to the operations room at HQ FC, HQ 11 Group, and Sector HQ at Biggin Hill. Two months later the filter room equipment was moved into another building at Bawdsey; this was known as Filter Room No.2, which had been specially designed as a result of the experience already gained. It was lined

[11] RDF (a compression of RD [radio detection] and D/F [direction finding]) From 1943, became 'Radar'
[12] Sanctioned by the Treasury in November 1935

with sound-absorbing material and had a larger map table which covered the coastal area from Dover to Norwich. This was the beginning of the filter organisation which was later to extend over the greater part of the UK. The first large-scale test of the interception system took place during the annual Home Defence Exercise in August 1938. RDF stations at Bawdsey, Canewdon, Dover, Dunkirk, and Great Bromley were in operation, passing their reports to No.2 Filter Room at Bawdsey. Filtered plots were sent simultaneously to the operations rooms at HQ FC, 11 Group, and to the sector stations at Biggin Hill, Hornchurch and North Weald. This time the filter room succeeded in handling the increased data and was able to 'filter' it and was able to inform (officially 'tell') the operations rooms which tracks to concentrate on and which to disregard. The plotting in the operations rooms also proved successful, despite their staff being of a part-time nature and lacking in any experience of this type of work.

4.4.3 NO.3 FILTER ROOM (BENTLEY PRIORY)

On the 29 September 1938, at the time of the Munich crisis, in addition to the first five service trial stations along the Thames Estuary, another three were added almost immediately, and steps were then taken to add another thirteen as soon as possible. War plans were made for the Bawdsey Research Station to be evacuated to Dundee, but an informal arrangement was made with the Deputy Superintendent and Squadron Leader Hart for a small group of scientists to form a research section at Bentley Priory. Squadron Leader Hart then went and organised the filter room in readiness for the summer air exercises of 1939 – inside Room 43B in the basement at Bentley Priory. This room was described as having the shape similar to a grand piano, the eastern wall with its two recessed windows had a gradual curve to meet a short northern wall which also contained recessed windows. The basement was accessed by two doors, at the eastern and western ends of the southern wall. The basement was lit by twelve, 100 watt 'rest-lights' with blue filters which were distributed over the map table. The orientation of the map table and its size was restricted by the shape of the room and clearance between it and the wall was allowed at the SE corner, being only sufficient for one man to pass comfortably. The western half of the room contained the majority of plotting positions. This space was dominated by the controller's raised dais fixed to a wooden platform accessed from a short stairway at the northern and southern ends. The height of the map table was 28 inches above the floor and the scale of the map was ½ in to 1 mile. Headphone sockets were provided on the inner and outer edges of the table so that plotters worked inside the coastline or from the outer limit of the table.

On the ground floor, three or four filter officers were employed in filtering aircraft tracks, they were provided with switching panels – two connected to nine stations and the third duplicated half each of the other two panels. A 7 ft high dais above the floor map enabled four tellers and the controller to look almost vertically down at the map.[13]

[13] AVIA 7/183

The map table through constant use was getting very dirty and the suggestion was made whether a map could be drawn on Harefield rubber flooring, a sample map drawn on a rubber map could be made, but this proved unsatisfactory.

4.4.5 NO.4 FILTER ROOM (BENTLEY PRIORY)

On 20 May 1939 the filter room was moved upstairs into a room adjacent to the experimental operations room, and it was here that the first operational RAF manned filter room was tested during the June air exercises, under the watchful eyes of AP Rowe, the Deputy Superintendent of the Bawdsey Research Station and AOC-in-C (Air Chief Marshall Sir Hugh Dowding) who immediately requested that a research section to be permanently stationed at Bentley Priory.[14] The scientists maintained a watch over filter operations and assisted in the education of the filter officers, whose duties were to supervise the entire operation of the room and who had comparatively little training in the art of filtering.

The last full-scale rehearsal of the air defence system before the outbreak of WWII, took place from 8 to 11 August 1939 and HQ FC manned the operations / filter rooms for three days continuously during this Home Defence Exercise. The preliminary report on the results of the exercise concluded that *the system, although doubtless capable of improvement as the result of experience, might now be said to have settled down to an acceptable standard.* The confused mass of information which had previously filled the group and sector operations room tables had been eliminated. Observer Corp reports were now coordinated with RDF tracks before they reached the operations room tables.

As a result of experience gained during the first few weeks of war, it became evident that the peacetime system of lettering and telling tracks of friendly and hostile aircraft required modification. The intention was to identify and allot letters or numbers of all aircraft appearing on the filter room table. Tracks of incoming bomber, coastal and civil aircraft were ‘told’ to command, group, and sector operations rooms. Tracks of aircraft that could not be identified as friendly or enemy would now be known as doubtful raids, and these were lettered ‘X’ followed by a serial number, such as X1 or X2 etc. Doubtful raids were to be told onwards by observer centres until they were recognised and reported by posts as friendly or enemy aircraft. This system came into effect from 12 September 1939.

The winter of 1939/40 filter room working was seriously handicapped by a high percentage of sickness, particularly among the WAAF. Although this was largely of a minor character, it persisted even though every precaution was taken such as regular disinfection of headsets, the wearing of face masks, and disinfection of the air by spraying. It became so acute that a three–watch system had to replace the usual four-watch system.

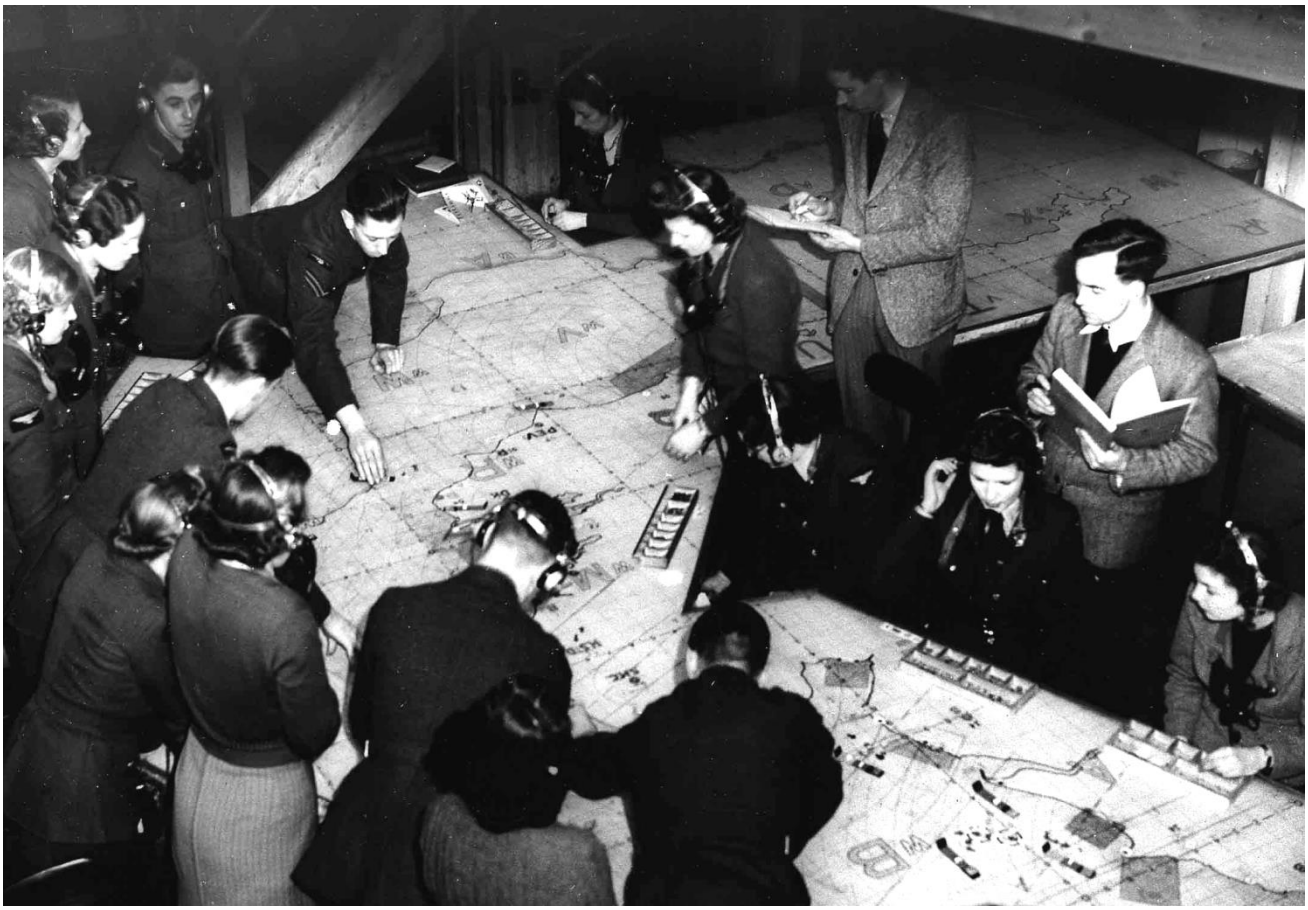
At the outbreak of WWII, eighteen (‘final chain’) RDF stations were operational, out of nineteen that were proposed in March 1939.

[14] In June 1941, it became Operational Research Section Fighter Command

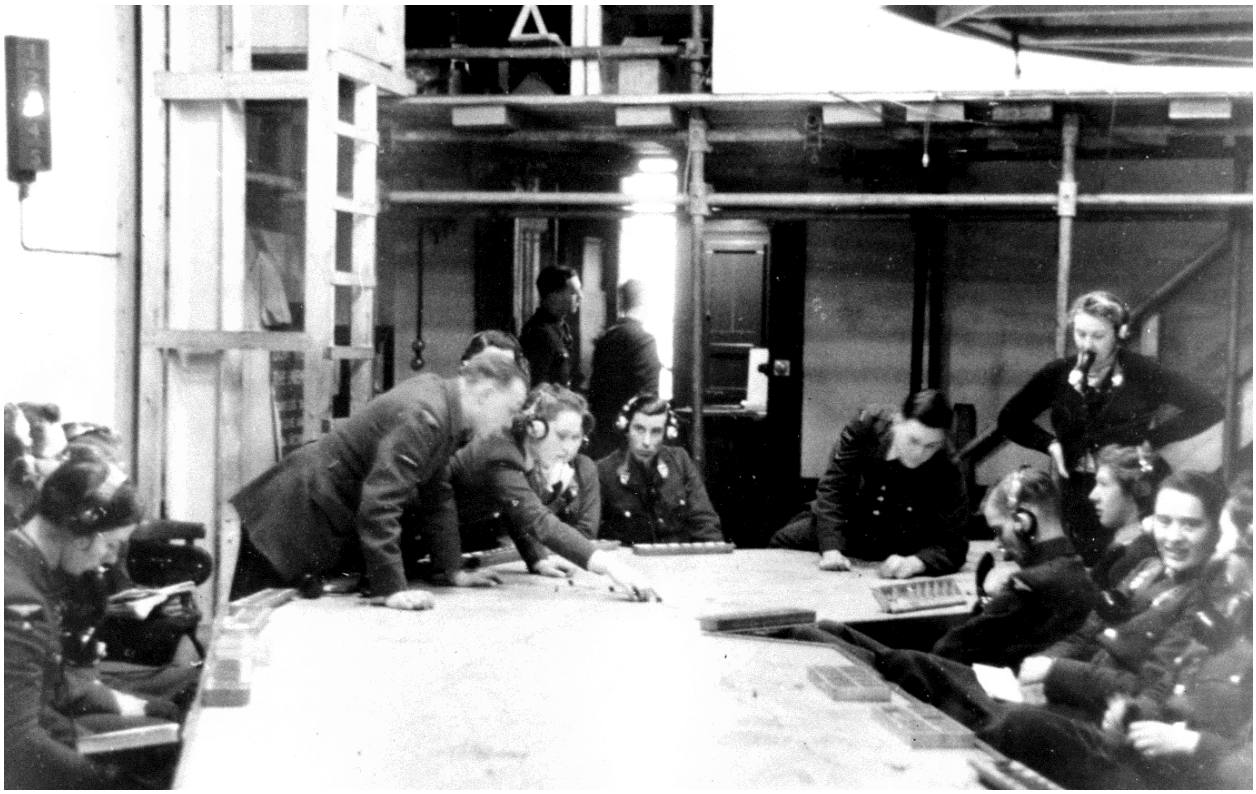
When the RDF chain was originally commissioned and when the first large-scale test was carried out during the air exercises of 1938, the results had been excellent within the natural limits of the restricted RDF cover then available. Yet despite having improved apparatus and a more highly developed technique, the results obtained from the RDF system had become markedly inferior to the results obtained in the early days. Realisation of this fact led HQ FC to carry out a detailed examination of the work of every class of individual employed in the chain. This examination in February 1940 led to the belief that the weak point in the organisation was the filtering in the command filter room. As a result a careful analysis of the work of the filterers was carried out by an expert RDF technician with the aid of accurately plotted series of tracks made on tracings from a series of raid plots by different RDF stations. These were then compared with the tracks produced by the filterers on the filter room map table using the same plots, and this proved beyond all reasonable doubt that the filterers were not capable of making a successful interception. A follow-up experiment was conducted using three physicists who were given the task as filterers. These men after a short training period showed remarkable aptitude for the work and produced excellent results. It was therefore decided that the trade of filterer would now be fixed at Pilot Officer / Flying Officer, instead of NCO wireless operators as used previously. Twenty corporals were employed as filterers, working on a four-watch basis; these were replaced with eighteen officers and the previous trade of sergeant floor supervisor was no longer required (as filterers were now officers) – these were in fact reinstated once the new underground block had been opened.

In early 1940 a filter school was established at Bawdsey, the recruits coming directly from a selection centre at Uxbridge; another school for WAAF plotters was established at Leighton Buzzard.

Plate 13: A replica RAF Operations room clock of the type referred to in the text. The pre WWII clocks had ten-minute coloured segments. This was soon changed to five-minute segments. Post WWII, with the appearance of much faster jet aircraft the segments were halved again to 2.5 minutes as shown. This clock is a Type 3.



Plates 14 & 15: Filter room Bentley Priory circa February 1940: Photo: RAFM



4.5 Filter Room No.5

Filter Room No.5 was located in the underground operations block, occupying room 6. When it became operational on 1 March 1940, it replaced Filter Room No.4, the first operational filter room, which had been established on 20 May 1939 next to the experimental operations room at Bentley Priory.

Information originating from RDF stations, obtained by instruments, often contained errors due to bad calibration, or observational errors such as height measurements. The function of the filter room as originally conceived, was to sort out, in order to 'filter' this information, and the teller would pass it on ('told') to the HQ FC operations room controller with the most likely answer. The controller then allotted a station to a raid, and prevented unnecessary duplication of information. This system had worked very well between 1938 and 1939 for the portion of RDF chain that was then in use, but with the expansion of the chain along the east coast of England and subsequently along the west coast, there was very little in the way of parallel development in the filter room or the multiplying of communication facilities, or even improvements in technique for handling the increase in information. Furthermore the creation of certain groups in parts of the country remote from command HQ, such as 14 Group in the north of Scotland, 10 Group in the west and 9 Group in the north-west of England only compounded the problem.[15] At the same time the profusion of plots pouring into HQ FC included those from the newly-added CHL stations which added to the congestion and delay. The first of these went operational during 1940 on 1 November at Fifeness, then Foreness and Walton (7 December), Easington (19 December), Shotton (24 December) and Happisburgh (25 December). These were all on exposed coastal sites and were part of the 'crash' CHL programme of the first nine sites. The programme of erecting CHL stations had begun because of the inability of the CH stations to detect low-flying aircraft.[16]

A report by the Committee on Night Air Defence under Marshall of the RAF Sir John Salmond, recommended decentralisation of the filter room. Under pressure from the Air Ministry in the autumn of 1940, the C-in-C Fighter Command reluctantly agreed to decentralisation and to split the filter room into several areas in various parts of the country. The C-in-C had felt that this scheme would not be practical until Identification Friend or Foe (IFF)[17] had been fitted to all aircraft operating over the sea.

The decentralisation came too late for the Battle of Britain and filtering was carried out centralised at HQ FC throughout the Battle. Decentralisation led to a complete reorganisation of the communication of the filtering system, with one filter room being allotted firstly to 9, 10 and 14 Groups at a nominal cost of £25,000 for each one. The existing filter room at Bentley Priory was then allocated to 11 Group which at the time was seen as an interim scheme until a new filter room could be built at Uxbridge. New filter rooms were also required for 12 and 13 groups, which it was felt had to be ready for the anticipated German air offensive for the spring 1941.

[15] AVIA 7/183
[16] Signals Volume 4: Radar in Raid Reporting
[17] Equipment fitted to RAF aircraft which returned a 'signature' when detected by Chain Home radar. See later

Information from the various RDF stations and Observer Corps centres within the group area was correlated (or filtered) in the filter room, before being passed to the group / sector operations rooms. This enabled operations staff at the various Fighter Command stations to have a complete picture of the activity in the area that concerned them. The Bentley Priory filter room, establishment in March 1940 for a four watch system, was as follows:

Headquarters Fighter Command

- Wing Commander – officer commanding filter room 1
- Squadron Leader – deputy officer commanding 1
- Squadron Leader – apparatus in aircraft, technical reports 1
- Sergeant – clerk, general duties 1
- Corporal – clerk, general duties 1
- AC – clerk 1

Filter Room

- Flight Lieutenants – Filter Officers 8
- Pilot Officers / Flying Officers – Filterers 18
- Flight Sergeant – in command filter room 1
- Sergeant – floor supervisors 4
- Sergeant – in command training 1
- Sergeant – analysing staff 1
- Corporal – analysing staff 1
- Corporal – clerk special duties 4
- AC – clerks special duties 151
- Corporal – clerk general duties 1

By October 1940, steps were taken to increase staffing levels by 15 % in the command filter room, because of the level of sickness experienced during the last winter, and also to take account of annual leave. The trade of ‘teller’ was upgraded from AC to Corporal.

The equipment in the filter room consisted of the plotting table on which was drawn a map of the UK; around it were a number of plotting positions fitted with jacks for headset connection. Other items of equipment included the following:

- Counters and plaques with counter trays for the plotters.
- Filter Officer’s desk with telephone keyboard.
- Identification officer’s desk with telephone keyboard.
- Tellers’ high chairs fitted with jacks for headset connection.
- Recorder’s small desk

The RDF reporting system in 1942 plotted all aircraft flying over the sea, and was used to assist in homing friendly aircraft in distress and to fix the position of friendly fighters beyond the range of R/T.

Identification was carried out through the medium of IFF. An IFF set was a radio instrument that was carried by all operational fighter aircraft, and which when it was in range of an RDF station, would send back a powerful signal once every twelve seconds. When this was received by the RDF station it was immediately recognised and indicated that a friendly aircraft was being plotted and this information was passed to the filter room. In 1942 two types of sets were in general use:

- Mark II (carried by most day fighters) which could be picked up by CH stations and ground laying radar sets
- Mark IIG (carried by all night fighters and a proportion of day fighters) and could be detected by CHL stations, GCI stations, and searchlight equipment.

In multi-seat aircraft (such as those of Bomber and Coastal Commands), the controls of IFF could be manipulated by a crew member so that in cases of distress, the coding switch could be moved from narrow to broad. When this signal was received at the RDF station, the filter room was informed and the plotting of this track was designated as an SOS and took precedence over all other tracks.

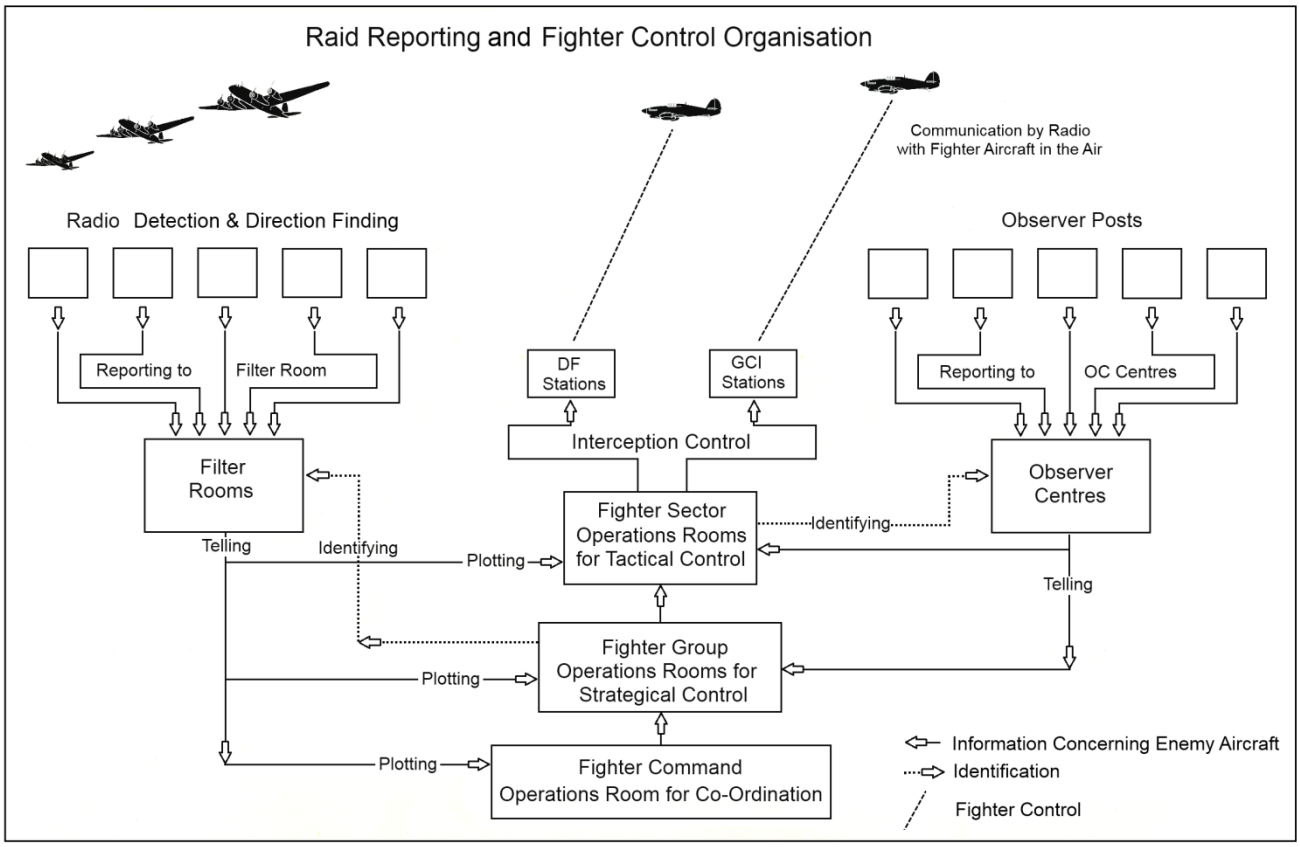
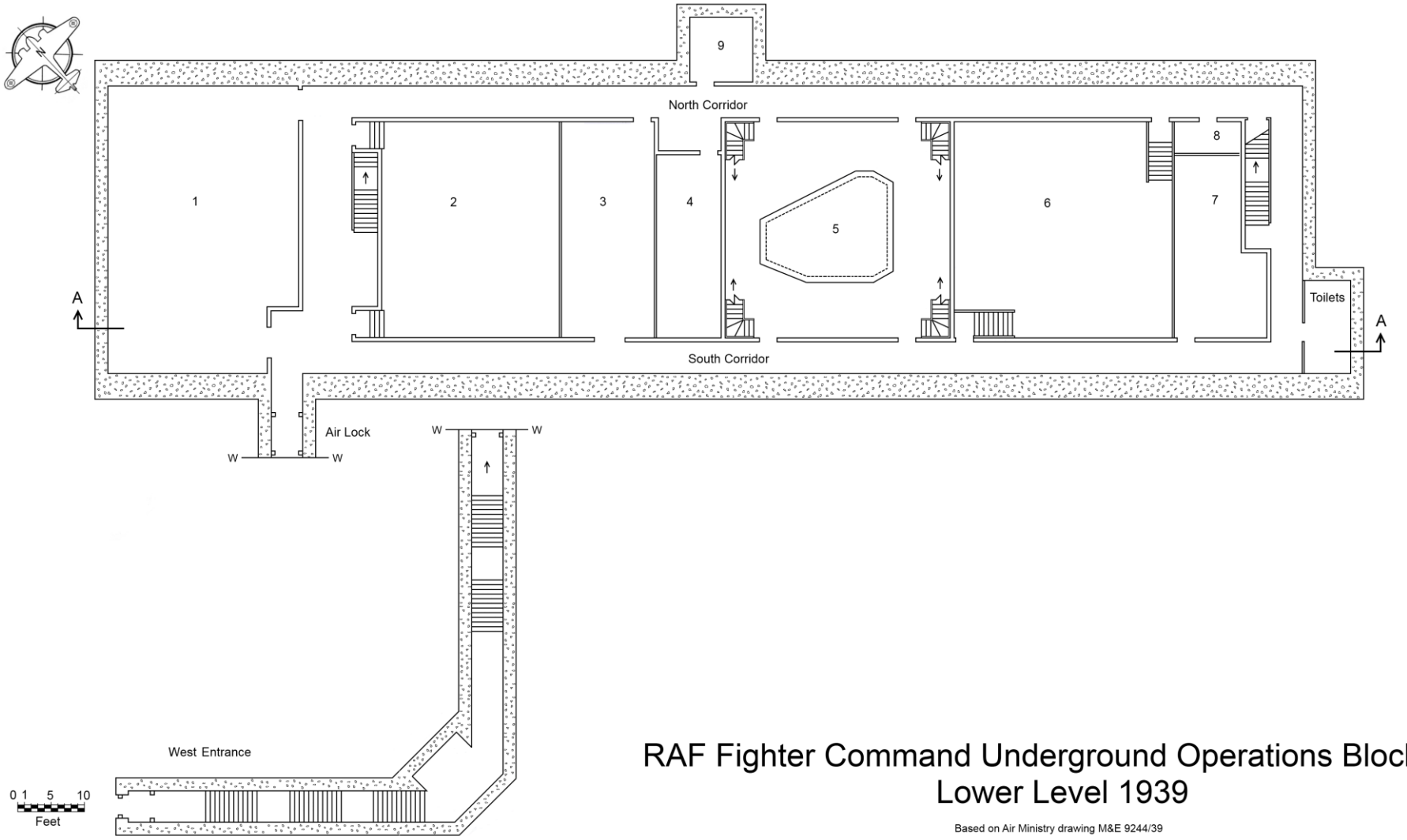


Plate 16: Raid Reporting and Fighter Control Organisation c. 1942.

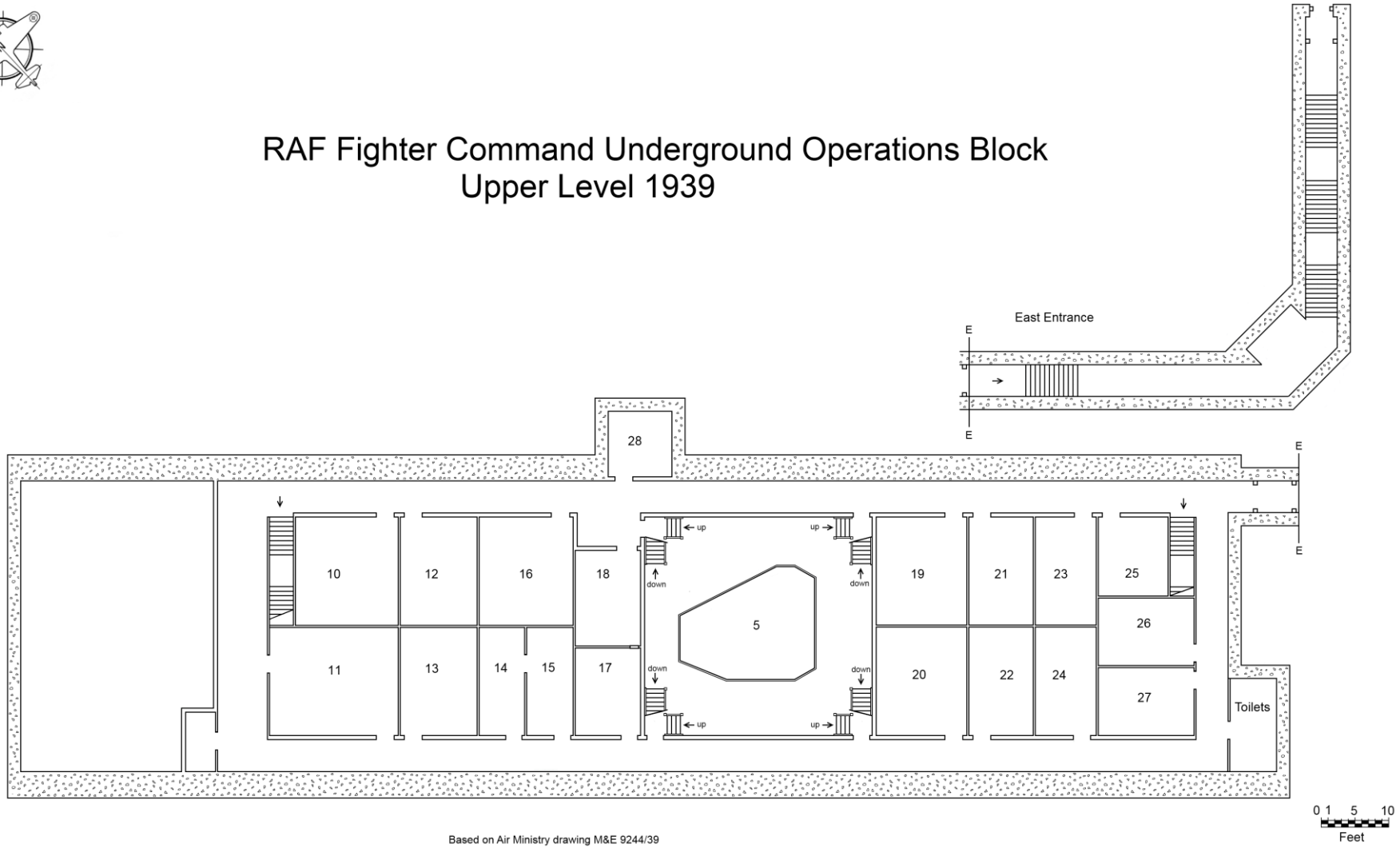
Over: Plates 17, 18 & 19: Plans / section of the underground building



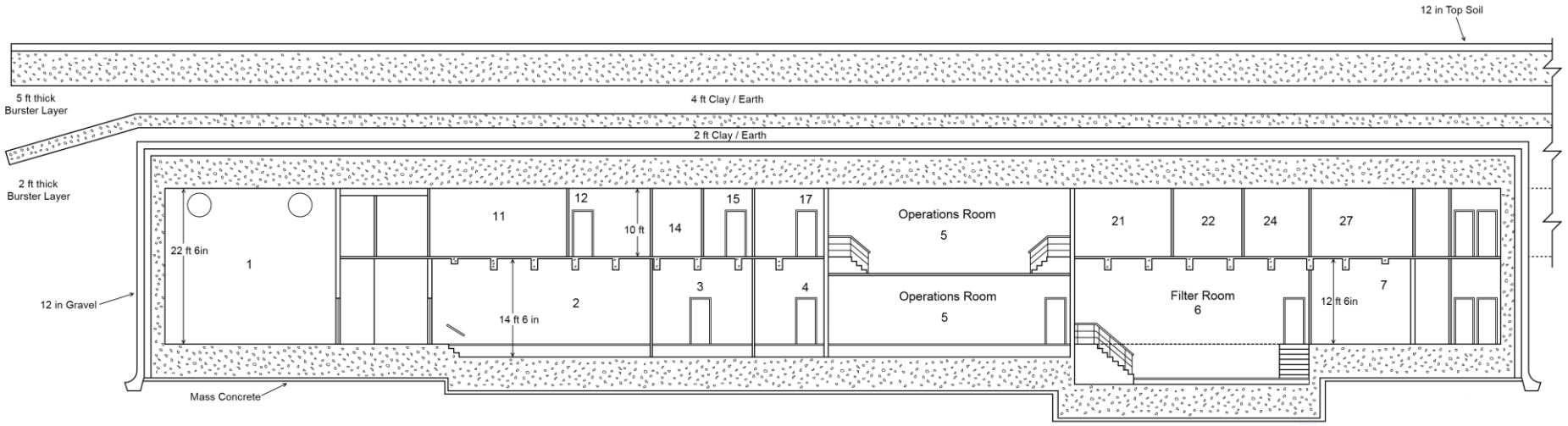
RAF Fighter Command Underground Operations Block
Lower Level 1939

Based on Air Ministry drawing M&E 9244/39

RAF Fighter Command Underground Operations Block
Upper Level 1939



Based on Air Ministry drawing M&E 9244/39



RAF Fighter Command Underground Operations Block

Section A-A 1939

Based on Air Ministry drawing M&E 9244/39

0 1 5 10
Feet

Chapter 5: The Underground Operations Block – Design and Construction

5.1 Location

The underground block is located at the eastern end of Bentley Priory and has been partially excavated into the Weald Ridge. The top of the mound is about 4 m above the original ground level; the area gently slopes from north to south.

The building was designed in the first instance as a type 2 operations block, it originally consisted of a two-level reinforced concrete box with three main floor areas. The lower level consisted of a plant room, operations room and filter room, plus GPO and a Deference Telegraph Network (DTN) room. The filter room floor, on the lower level was in fact a basement which gave it sufficient height for its map table to cover the whole of the UK. The upper level contained the upper portions of the plant and operations rooms and suites of offices.

5.2 Sanction and Original Cost

The estimated cost of the underground structure in March 1939 had been increased from £40,000 to £60,000 plus an additional Post Office expenditure of £7,000. Doubling the burster layer would add another £11,000 and, if water was found in the excavations, an additional cost of £10,000 would be involved.

5.3 Contractors

The firm, Howard Farrow Construction Ltd of Colindale was the main contractor for the building work and their representative was Eric Farrow. Sub-contractors included the following:

- Demolition & Construction Co Ltd (cables)
- Bower Engineering (electric wiring)
- Donald Smith & Co Ltd (ventilation)
- Lamson Engineering Co Ltd (pneumatic tubes).

5.4 Design

Unfortunately the general arrangement drawing(s) have not been found, although an existing sketch drawing, 3238/39 is counter signed by JH Binge, the draughtsmen being LK Redmond.[18] The final design is quite different from the original one which was planned around the requirements as published as FC/5/5761. The working drawing, which included the filter room, was BPT 14/3 – dated 09–06–38, which itself was based on the earlier drawing 7095/37 (without filter room?). Internal dimensions were:

▷ 40 ft by 132 ft

This was replaced by 7538/38, also designed by JH Binge, which had the following internal dimensions:

▷ 40 ft by 149 ft 6 in[19]

[18] Known Air Ministry drawing numbers are 1281/39, 1291/39, 1846/39 & 2327/39, but none of these have been traced.
[19] AIR2/1812

At this point in time, the only other Fighter Command underground building being designed was that for 11 Group at Uxbridge. The command operations room required a room far bigger and of a greater height than a group operations room as the map table covered a far larger geographical area. The final design for Bentley Priory was a larger building with the following internal dimensions:

- 46 ft 6 in by 192 ft (minimum not including a projecting toilet annexe)

The as-built design is based around a perimeter network of corridors, around all four sides. The technical area was inside the corridor layout, which allowed for easy communications between rooms as the rooms themselves were only accessed from the corridors (though a couple were interlinked). The other huge advantage of this scheme is that the main supply and exhaust ventilation trunking routes could be aligned down the main longitudinal corridors, hidden above suspended ceilings. Fresh air was supplied to each room, along the north corridor, and dirty air was collected along the south corridor. Wherever possible the access routes for this service to and from each room were above the doors. The simple operation of this ventilation scheme was achieved by having a single plant room at one end of the block, instead of two separate plant rooms located adjacent to the entry and exit tunnels as originally planned. The only civil engineering disadvantage of the final scheme is that it was also necessary to have four additional horizontal tunnels, radiating both fresh and exhaust air protecting out from the plant room and finishing with vertical stacks above the surface some distance away. The horizontal and vertical tunnels were constructed of 3 ft 3in (id) diameter pre-cast concrete pipes, which finished on the surface as brick stacks. The two vents of the intake stack were 26 ft above their horizontal tunnels and the two vents for the exhaust stack were 19 ft 5 in above their horizontal tunnels. To ensure that the pipes did not shift, a foundation curtain wall had to be constructed (with 'E' quality concrete), below the horizontal route of the tunnels.

5.5 Construction

Construction is of monolithic concrete (the specification is unknown), the floor and roof thickness is 4 ft 9 in (1440 mm) and the longitudinal exterior walls are 4 ft (1220 mm) thick but end walls are 2 ft (0610 mm) thick[20]. Interior walls were nominally 9 in (254 mm) and 4.5 in (127 mm) brick. A concrete slab first floor was provided over the entire building except for the plant room and the operations room; this gave a first floor headroom of 10 ft. These two slabs were supported by a series of concrete down-stand beams at 5 ft 6 in centres.

Total dimensions of the as-built shell of the main building were as follows:

- Length: 164 ft. Width: 46 ft 6 in
- Concrete floor to concrete ceiling: 22 ft 2 in(not including the filter room)
- Plant room length: 30 ft long. Plant room width 46 ft 6 in.

[20] Drawing FCW/35/51 shows pre-fabricated walls but this is not backed up by records in TNA

Despite the fact that by 7 February 1939, contacts for heating, ventilation and electric cabling had not been let, the electric wiring was assumed to have been completed by the end of May 1939, the ventilation and air conditioning by the middle of June, – but this estimate proved incorrect.

5.6 Increased Size and Behind Schedule

The contractor Howard Farrow Construction Ltd sent a memorandum to the Air Ministry, outlining that the bill of quantities as of 25 January 1939 had been reached and of the additional costs involved for an underground building of increased size. The amount of earth removed that the company had originally quoted for had already been removed for a structure 120 ft 9 in by 47 ft 6 in and 27 ft 7 in deep to the underside of the bottom slab to upper surface of the top slab (as shown on AM drawing 7539/38). They had based their tender on using scrapers as only 7,609 cubic yards would have had to be removed, but the revised design would require the removal of 17, 306 cubic yards and if they had known this, the company would have used heavier equipment. The surplus amounted to 14,012 cubic yards at a cost of £4,304. The amount of concrete in the walls, floor and roof had also been increased to 5,568 cubic yards against a bill of 2,391 yards. Reinforcement was increased to 10,200 cwt against a bill of 3,116 cwt which was an addition of 40% more reinforcing per cubic yard of concrete. Props supporting the roof had also be to be stouter and longer as now the average height was 24 ft whereas that given in the bill of quantities was just 17 ft 8 in. The extra building works would cost an additional £18,057 making a total of £41,752; this figure is that charged by Howard Farrow Construction Ltd for the building work but does not include the additions to the burster layers, or any fittings etc.

As progress was slow because of the increased size, a meeting took place on 25 August 1939 to consider ways of permitting occupation of the whole or part of the shell of the building and fit it out with temporary cabling, wiring and ventilation by 30 September 1939. The representative from the building contractors suggested that this could be achieved by omitting reinforced concrete beams at first floor level and substituting these with RSJs and constructing a timber shell within the main walls. The west entrance was nearly completed and it was assumed to be ready for sub-contractors by 7 September, and the permanent work for the east entrance, by 30 September. In the end concrete beams were built which were down-stand beams, being cast as part of the floor slab.

The roof was due to be completed on 1 September, and the middle floor and partitions by 1 October.

The concrete beams had to be completed and all shuttering removed before the ventilating plant / trunking, cabling and heating pipes etc could be fitted, so this could not begin before mid-November. Another problem was that the plant room was being used as a store room by the contractor. The GPO could not begin, fitting their equipment until the building was dry, heating and ventilating ducts had been fitted, and the building was dust-free.

5.7 Burster Layers

The original design followed on similar lines to that for the 11 Group underground operations block at Uxbridge and therefore allowed for protection against a direct hit by 500 lb or 250 lb special armour piecing (SAP) bomb. This scale of protection was decided upon as a result of a thorough investigation from which it was concluded that it was impractical to obtain complete protection for the organisation by relying entirely on underground construction. The protection was afforded only to the underground building, together with its occupants and the communications machinery with which it was equipped. In order to obtain immunity from a direct hit by heavier types of bombs, it would have been necessary to excavate below the level at which water is present and even if a coffer type of dam construction was employed, a near miss might damage the structure sufficiently to start water leakage and consequent flooding.

While it was under construction, questions were being asked whether its protection could be increased to resist a 1,000 lb bomb, however this was not possible without stopping work but the Directorate of Works agreed to increase the thickness of the burster layer to increase the protection to 500 lb Semi Armour Piercing (SAP) and gave orders to this effect on 8 May 1939. The D of W also considered the question of placing armour plate instead of extra concrete. The quantity required would have been 40,000 square feet, the weight 1,800 tons and the cost £200,000. The Admiralty had priority of all armour plating and it would have taken until the middle of 1940 to get the expected delivery and even then, Admiralty approval had first to be obtained. A better insurance against the destruction of the operations block was to duplicate it!

The burster courses as-built consisted of a secondary layer which is 2 ft thick (610 mm) and this extends 15 ft beyond the building. It is separated by a 2 ft thick layer of clay above the roof of the underground block and above this is another 4 ft (1220 mm) layer of clay. This is followed by the primary layer which is 5 ft (1524 mm) thick and this in turn is covered with earth with a nominal thickness of 1 ft (305 mm). The reinforcement through the 5 ft primary layer consists of a lattice diamond grid arrangement of ¾ in diameter steel rods. These have 3 in of covering concrete (on all sides) along with a horizontal row of ½ in diameter rods. The secondary layer was reinforced with two layers of square mesh reinforcement weighing 13.5 lb per square yard.

5.8 Private Branch Exchange

The new exchange was designed to be permanently manned, with 300 internal positions, 100 private wires, long distance and 20 exchange lines. The room was 35 ft long and 13 ft wide and contained the switchboard, associated relay apparatus and a distribution frame. The estimated cost (30–11–38) was going to £1,500, three times more expensive than for Uxbridge, Hucknall and Newcastle.

By the latter half of December there was a delay in furnishing the operations and filter rooms and in the provision of the tables. The GPO required between four and six weeks to complete their

work in these rooms, once the two rooms had been handed over to them from the contractor. It is believed that this time scale was reduced with the help of overtime, at the Air Ministry's expense.

Additional teleprinter circuits were acquired during September between the operations room and the three fighter groups for the transmission of special information. These were:

- F.148 and F.149 Stanmore HQ FC to Uxbridge, No.11 (F) Group (channel 11 of the Stanmore–Uxbridge VF Telegraph system
- F.146 Stanmore HQ FC to Hucknall HQ, No.12 (F) Group – set up on channel 5 of the Stanmore–Hucknall VF telegraph system
- F.147 Stanmore HQ FC to Newcastle No.13 (F) Group – at this time, the voice frequency telegraph system was not yet open.

In the intelligence room there were three spare teleprinters, having tables Tg 995, which were due to be replaced with tables type DTN 2000, and a fourth machine had been requested from RAF Yatesbury.

The underground block finally opened on 9 March 1940, about ten weeks behind schedule due to an altered specification as well as the effects of several significant landslides during its creation.

5.9 Pillbox Switching Scheme

During construction, the route of the main telephone cables had to be changed due to settlement problems of the made-up ground. The original intention was to have the leading-in points spaced around the building at a depth of roughly 20 feet below the new ground level. This was carried out at Uxbridge, but the scheme proved unworkable as it involved laying the pipes in made-up ground with a very heavy weight of earth above them. It was found that even with supports underneath the pipes, they would shift with very likely damage to the cables. The alternative was to have duplicate cables, and run them down each stairway (Air Ministry drawing 9625/39), so in the event of damage to one stairway, the other set of cables could be used. The disadvantage to this was that the cables were crowded together at the entrances and that they were only a few feet below surface level, so that a single bomb might put out of action at least half their total.

To carry out this task, the cables had to be terminated some distance from the underground block, protected inside three pillboxes (or kiosks), located at points where the cables could be cross-connected if one was severed. For example, if the west entrance was destroyed , or the pipe lines around it, the communications carried in the Bushy Heath Exchange cables could quickly be restored by the reversal of 'U' links inside pillbox 'X' as well as inside the underground block, those rerouting the Bushy cables from cable run 'A' to 'B'.

The cables were to be installed by the General Post Office, inside steel conduit (3¼ inch diameter mild steel screwed barrel) running from these to the main building. The idea was first discussed in April but by 19 August the locations were still being discussed, despite the fact that the completion date for the construction of the underground block was at that time set to be November 1939. The structures (see Plate 2), known as 'X','Y' and 'Z', had internal dimensions of 8 ft by 6 ft with a

ceiling height of 7 ft. Construction was to be 13.5 inch walls with 6 inch concrete slab roof, a timber door and window was also to be provided. They were to be electrically heated in order to maintain good insulation on the changeover panels. All three were completed by December 1939 and this scheme was later implemented to support the operations blocks of 12 and 13 Groups. They were constructed to Air Ministry drawing 9553/39; one was built on Air Ministry property, one on land in the ownership of Middlesex County Council, and the other was on building plot of ¾ acre at a cost of £1,550 (see Appendix 2).[21]

By 1 January 1939, the new private branch exchange was completed, telephone exchange circuits were provided to General Post Office telephone exchanges at Watford (allocated tele-phone numbers 9240–9249), Colindale (5221–5224) and Pinner (5691–5693).

5.10 Duplicate Fighter Command Operations / Filter Block

Under discussion in March 1939 was the idea that the operations room and warning system of HQ FC should be duplicated. One suggestion was an interim scheme involving adapting an existing hut adjacent to the Air Ministry Teleprinter Centre in the town of Leighton Buzzard. This would cost the Air Ministry £1,600 for reconditioning the old building, cabling and equipping plus £28,000 per annum line rental (New GPO lines would be required from RDF stations to the nearest sector and from there to link Leighton Buzzard in with DTN. Also new reserve lines from Leighton Buzzard to RAF groups were needed, plus the hire of teleprinters). If the long term policy was implemented, then a new site had been found at Liscombe Park and there would be a further cost of £5,000 for additional cabling.

After May 1940, a reserve HQ FC operations and filter block (FCW187/30/4) was established at Liscombe Park, some two miles west of Leighton Buzzard. The Air Ministry Teleprinter Centre had already been established in the town, inside the Corn Exchange. The town of Leighton Buzzard is 23 miles from Bentley Priory, and an existing building in the town was in use as a temporary operations room, until the construction of a new camp in 1943. The emergency filter room / operations room (Hut 21) at Leighton Buzzard became the new Fighter Command Teleprinter Centre at an estimated cost of £5,050. It later functioned as HQ ADGB Emergency Operations Room (EOR), and was finally disbanded in June 1944 when it was handed over to 26 Group for use with the broadcast telephone service required for Bomber Command and AEAF. By 2 January 1944 the Corn Exchange teleprinter section had been removed and reinstalled inside the duplicate filter room (which had never been used operationally) at Liscombe Park.

[21] AIR2/2997

Plate 20: A similar but different view to Plate 1, showing the interior of the underground operations room. Photo: RAFM

5.11 HQ Fighter Command, Emergency Accommodation

Once the pillbox switching scheme had been commissioned, arrangements were made before March 1940 for an emergency HQ from which the operational functions of FC could be continued in the event of the underground operations block or Bentley Priory itself being destroyed. It was proposed to take over a large house near Bentley Priory known as '*Tanglewood'* for use as an emergency HQ for the administrative staff. This building would be occupied for the following reasons:

- As a result of the evacuation of Bentley Priory, while the underground block was still functioning
- On the complete evacuation of Bentley Priory, including the underground building.

Communications for *Tanglewood* had to be completely independent from the underground block, and a switchboard with cabling to the underground block was needed, with a connection to one of the pillboxes at which the following circuits could be picked up:

- Speech circuits to HQ 10 Group–Colerne, 11 Group–Uxbridge, 12 Group–Hucknall, 13 Group–Newcastle, and 22 Group–Farnborough
- 2 teleprinter circuits and 2 speech circuits to RAF Central–Leighton Buzzard
- 3 exchange lines to Watford GPO exchange.

5.12 Old Operations / Filter Rooms

Some of the components, including 1 to 5 minute light indicators, coloured clocks, the operations and the filter officer's tables, once part of the original operations and filter room set up at Bentley Priory were removed after May 1940 and taken down to the training filter room at the Radio School, Yatesbury. The balance of the equipment was returned to stores at Kidbrooke.

5.13 Wartime, 1942 to 1945

Around July 1942, an additional reserve accommodation to house the administrative staff of HQ FC in the event of evacuation of Bentley Priory was found. It location was at Hanstead House, Bricket Wood, near St Albans. The house was not to be requisitioned, but the owner, Lady Annie Henrietta Yule, was informed that should an emergency arise the house would be taken over at short notice.

In October 1942, it was proposed that a filter training scheme should be introduced in two rooms, one containing a plotting table complete with plotting positions, while the other was to be used as a telling office and had telephones, through which lists of dummy plots were passed. All the plotting circuits were to be passed through a monitoring keyboard situated in the plotting room so that the officer or NCO in charge of the training could supervise the plotting – it unknown whether this scheme was put into operation.

By the end of 1942, the three existing GPO 216 pair outlet cables had been fully utilised and so, it became necessary to install a new 308 pair outlet cable 250 yards away to pillbox 'Z' and to duplicate this on alternative routes to the underground building. These had to be connected to a

new GPO main cable that was in the process of being laid between St Albans–Watford–Slough. A diversion was also required to service the new 11 Group filter room at Hill House.

From March 1943, on the proposed formation of HQ Allied Expeditionary Air Forces (AEAF), the Bentley Priory filter room in the underground block was required for conversion to the Inland Reporting Centre. This was in preparation for the forthcoming invasion of occupied Europe. The idea was first discussed in April 1942, but at this time it was still unknown where the 'new' 11 Group filter room should be located. Eventually it was decided that it should be closer to Stanmore and around January 1943 a location was found at Hill House, Stanmore, and until this became operational, the underground block then had the dual role of HQ AEAF (operations), and No.11 Group Emergency Filter Room. Changes to the layout, implemented from March 1943 which was due to be completed by 1 May, were as follows:

- Room 4, formally a rest room became a Naval plotting room
- Intruder operations room (room 20), was transferred into Rooms 14 and 15 and the intervening partitions were removed.
- The War Room was extended to include rooms 19, 20, 21 and 22 with the removal of internal partitions to accommodate up to 20 people.
- Codes and Ciphers (rooms 14 and 15) transferred to a new over-ground cipher office
- Meteorological office was also transferred over-ground beneath camouflage netting.[22]

AEAF formed on 15 November 1943 at Kestrel Grove, Hive Road, Stanmore, with a section at Norfolk House, St James's Square, London SW1. It controlled 2nd Tactical Air Force, ADGB, Nos.38 and 85 Groups. Air Defence of Great Britain reformed at Bentley Priory on the same day as AEAF, by redesignating RAF Fighter Command; it reverted back to its original command title on 16 October 1944.

5.14 Immediate Post Way, 1946 to 1952

On 1 June 1946 a permanent exhibition opened inside the underground operations room. It was planned and organised by AVM Sir Stanley F Vincent which he established inside the now disused HQ FC operations block. It included a replica of the night intruder room, located inside the filter room. This had displayed, plotted maps, charts, photographs, and report files to illustrate a typical night's work by intruders – actually the night of 4/5 April 1945 in support of bomber operations. Precise details were given of 'take-off', 'on target' and 'ETA' times. Nearby was the historic FC operations room plus the main exhibition room which was located inside the former AEAF war room. This told the story of the development of Fighter Command over the past twenty years. The exhibition lasted until June 1950, when it closed down to allow for refurbishment of the building.

Around 1946 HQ FC appointed Group Captain John Cherry to examine the existing system in light of an appraisal for a future 'control and reporting' system. He initially recommended two separate stages of a development period for the new C & R system, these were:

[22] AIR 2/2997

- Stage one – implemented before November 1947, involved a reorganisation of the structure of the system to conform to SD564. Sector operation centres (SOCs) were set up at the appropriate GCI radar stations, and aerodrome sector operations rooms were closed down. Filter rooms were retained (until November 1947) for the receipt of track information from chain radar stations and the broadcast of a composite air picture to operational users.
- Stage two – this arranged for the closing down of filter rooms, and for sector operations centres to receive track information direct from their dedicated chain stations and to broadcast a complete air picture to operational users.

The second stage would involve the retention of eight CH stations to provide sufficient early warning high cover to enable high speed interception trials and realistic defence exercises to be held. The existing CHL and CHEL providing medium and low cover were all closed down and put on a care and maintenance basis, to be brought back into use for defence exercises and for training auxiliary personnel as necessary. The HQ FC development area consisted of the following:

Sector Operations Centres

- Yorkshire (21–07–47) Patrington (nr Hull), became Northern Sector on 01–12–50
- Eastern (14–07–51) Neatishead, Norwich
- Metropolitan (14–07–47) Trimley Heath, Felixstowe, Suffolk
- Southern (01–09–47) Sopley, Christchurch, Hats
- Caledonian (09–10–51) Barnton Quarry, Edinburgh
- Western (15–12–50) Longley Lane, Preston

Satellite GCI Stations

- Sandwich Wartling Langtoft

Inland GCI Stations

- Unknown

CH Stations

- West Beckham Bawdsey (plus CHL) Ringstead Stoke Holy Cross
- Stenigot Swingate Rye Poling

From this point onwards (1946/7) the underground building at Bentley Priory had no radar or radio links with airborne fighters; its objective was to receive information on plots and data passed to it over telling lines from the six SOCs.

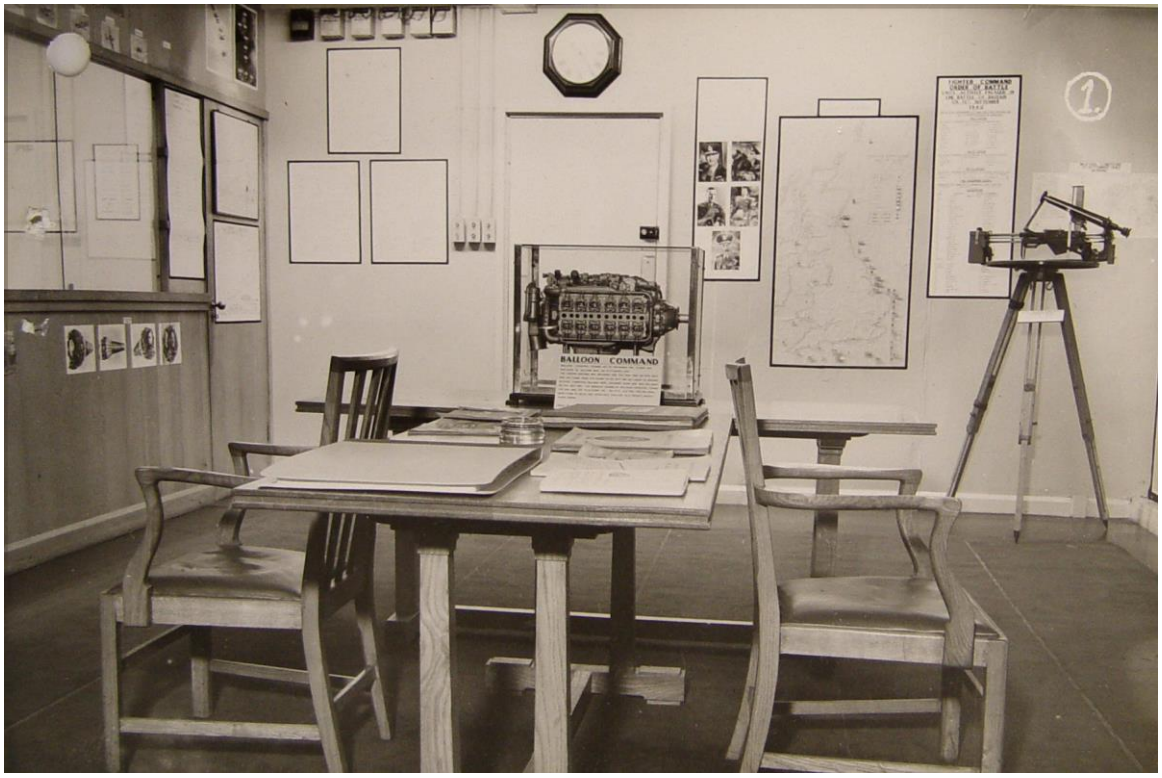
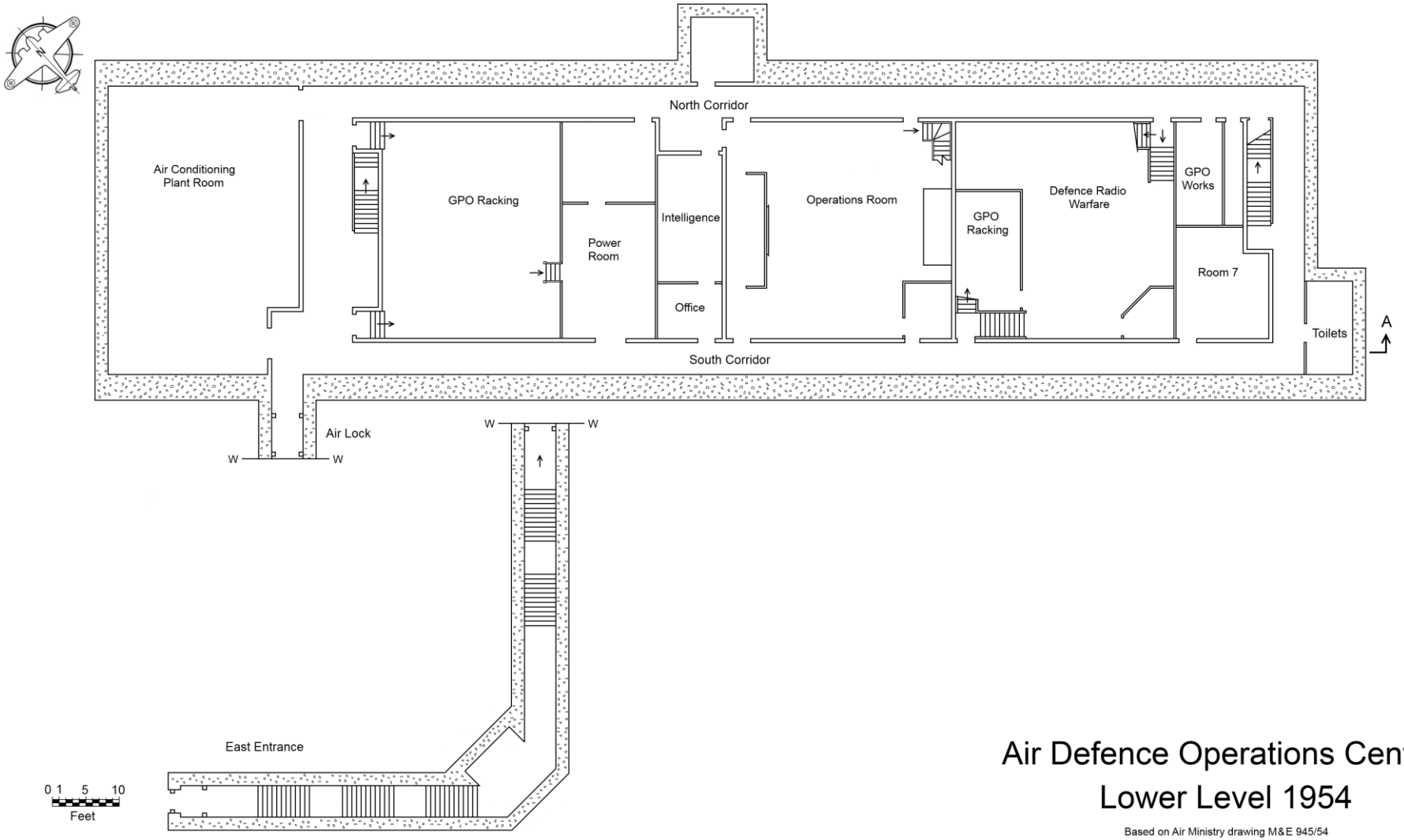


Plate 21: A museum display room c.1947. Photo: TNA

Plate 22: Operations Room c.1947. Photo: TNA

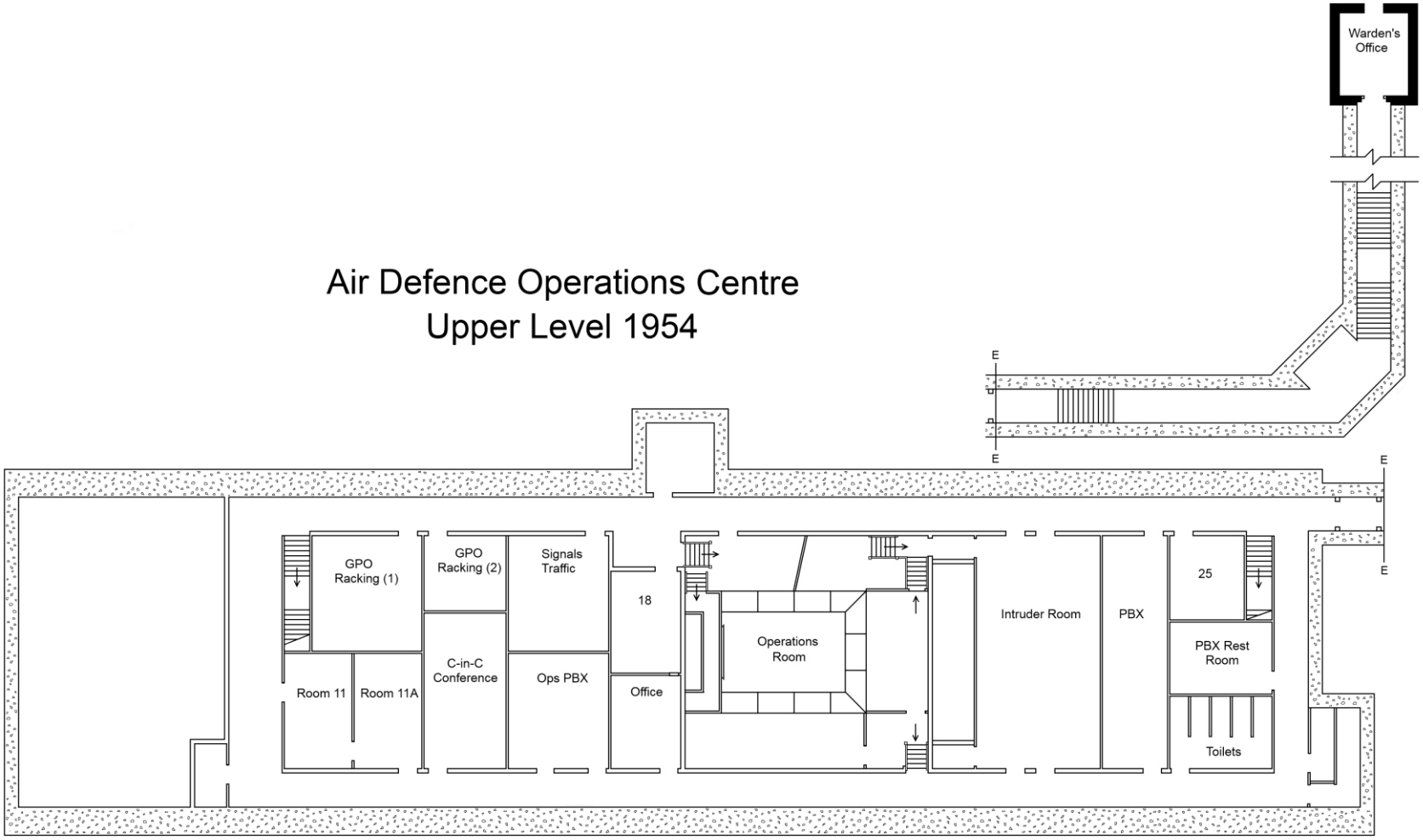
Over: Plates 23 & 24: 1954 plans of the underground Air Defence Operations Centre



Air Defence Operations Centre
Lower Level 1954

Based on Air Ministry drawing M&E 945/54

Air Defence Operations Centre
Upper Level 1954



Based on Air Ministry drawing M&E 945/54

5.15 Air Defence Operations Centre

5.15.1 Formation and Function

The C-in-C Fighter Command, as Air Defence Commander, was responsible for the Air Defence of the UK against air attack. As part of a general modernisation programme of UK air defence a new unit – Air Defence Operations Centre (ADOC) was established utilising the old command operations room at Bentley Priory to provide the means through which the ADC could discharge his responsibility. Although a separate organisation, it was administered by HQ Fighter Command.

The ADOC completed the formation of the Air Defence Battle Organisation, which was the channel of control consisting of ADOC to SOC, to Fighter Wing, and Gun Operations Rooms. ADOC's role in war therefore (in 1954) was to provide the facilities by which the Air Defence Commander could direct and coordinate the Air Defence Operations of the UK.

ADOC's function was as follows:

- To appreciate the immediate air threat to the UK and advise sector operations rooms
- To maintain a state of readiness of UK air defences appropriate to the threat
- To authorise or initiate inter-sector air reinforcements as required to meet the air threat
- To coordinate and direct where appropriate the defensive radio warfare organisation for all air operations over the UK
- To provide a tactical intelligence network between ADOC and SOCs
- To recommend changes necessary in standard operating procedure
- To provide an operations centre in peace time to train and practice through the medium of synthetic and flying air exercises.

The status of ADOC and its relationship to HQ FC was similar to that of SOC to a Group HQ.

ADOC was formed at Bentley Priory on 23 February 1953, but it was not until 26 October 1953, that it was operating on a single-watch daily basis (09.00 to 12.30 and 14.00 to 17.00 hours) except during major exercises. Prior to October it was mainly in use for training purposes, which included monthly synthetic air defence exercises, lasting three hours when AOC was fully manned. There were also several major live exercises, such as *Momentum*, *Coronet* and *Mariner* when additional staff had to be brought so that ADOC could be manned on a wartime basis.

New ADOC office accommodation was allotted in 1954 to ADOC (Uni-Seco huts erected adjacent to the operations room site).

5.15.2 Modifications

It is unknown exactly when the interior modifications were carried out – it may have been in support of ADOC. The main structural alteration to the 1939 building was that the east and west walls of the eastern air lock were demolished and rebuilt to create a 10 ft by 13 ft warden's office.

Room status as at April 1954 was as follows (note room numbers remain as 1939):

Lower Floor

- Room 2 GPO racking
- Room 3 remained unchanged
- Room 4 Intelligence
- Room 5 Operations room
- Room 6 Defence radio warfare
- Room 7 was made smaller
- Room 8 made larger to become GPO workshop
- Room 9 Kitchen

Upper Floor

- Room 10 GPO racking (1)
- Room 11 sub-divided into rooms 11 and 11A
- Room 12 subdivided to become GPO racking (2) and C-in-C conference room
- Rooms 14 / 15 become Ops PBX (combined in 1943 as the intruder ops room)
- Room 16 Signals traffic
- Rooms 17 / 18 remained unchanged
- Rooms 19 / 20 Intruder room (combined in 1943 as war room)
- Room 21 / 22 combined to become a PBX
- Rooms 23 / 24 combined to become a PBX
- Room 25–27 remained unchanged with room 27 becoming a toilet

5.15.3 OPERATIONS

Exercise *Running Tide* was a typical simulation which took place in October 1955. This involved cooperation with the Royal Navy, and involved only the Caledonian Sector; this unit was therefore responsible for operation order, air combat and air traffic safety etc. The exercise was watched from the 'bridge' of the ADOC. The operation consisted of raids against the east coast of Scotland by aircraft of the carrier force, plus attacks by aircraft based in Caledonian Sector against the fleet, reinforced by Meteors from Church Fenton. Unfortunately much of the value of the exercise was lost due to Caledonian Sector's inability to distinguish between incoming raiders and friendly aircraft returning to base![23] Caledonian Sector was disbanded in November 1957.

On 1 September 1956 the centralised plotting centre – formally 11 Group's filter room at Hill House closed down.

By the late 1950s, it was becoming clear that the Air Defence Commander, working in the ADOC bunker, required information on nuclear fallout and bomb bursts in order to deploy fighter aircraft effectively. It was therefore decided that the ROC should occupy part of Room 6. As from 1 October 1962, ADOC took over from Patrington, responsibility for Quick Reaction Alert (QRA).

[23] AIR 29/2416

5.16 Later Years, 1960–1971

5.16.1 Replacing the Plant

By 1963 the workload of the original ventilation and plant was seen as inadequate to cope with a staffing level of 100 plus the appropriate heat dissipation from the extra computing power. Its throughput was a mere 10,000 cu ft per minute, and it was wasteful in operation in that heated air was fully exhausted from the building into the atmosphere. Furthermore the old plant did not provide humidity control or filtration against fallout. It was proposed to retain the existing plant and use it as a stand-by unit. An output of 20,000 cu ft / min was required; also the old trunking needed replacing with larger capacity ducting routed to carry out an air change of six times per hour. New plant would provide for recirculation of air, the condition of the air, and fallout filtration; the cost was expected to be £17,000 for the financial year 1964 / 5.

During the plant refit, which began in September 1964, the ventilation trunking was also replaced, with new air supply ducts from the plant room running the length of the northern corridor to supply all rooms *en route* with fresh air. Also the extract ducting, taking stale air back to the plant room via the southern corridor of both floors, was also replaced. The room layout of both floors had changed slightly since WWII, but these were superficial, with some partitions removed; the main structure including all the concrete floor slabs and corridors etc were as-built:

Lower Level

- Room 1 AC plant room
- Room 2 GPO racking
- Room 3 Battery and power room
- Room 4 GPO office
- Room 5 Operations room
- Room 6 Royal Observer Corp and radar room
- Room 7 sub-divided into SNCO's office and PBX

Upper Level

- Room 10 GPO room.
- Room 11 Ops workshop.
- Room 12 had been made smaller for use as a GPO frame room.
- Room 13 the conference room had been made bigger, occupying space which was formally part of room 12
- Rooms 14–16 & 18 combined to form the teleprinter room.
- Room 5 Operations room (upper level)
- Rooms 19 / 21 combined to become the intelligence room
- Room 22 C-in-C's office
- Room 22 made smaller to become the Derby room (?)
- Room 24 Control signals
- Room 25 Signals office
- Room 26 Officers' rest room
- Room 27 WAAF lavatory

5.16.2 OPERATIONS

With effect from 1 October 1962 the ADOC took over executive control of the Quick Reaction Alert aircraft and missiles from Patrington. This was partly due to the ADOC establishment of controllers being increased from five Flight Lieutenants to five Squadron Leaders, which reflected the importance of the responsibilities of the duty controller both for alerting forces and being the first authority in the event of an unusual incident. The display equipment was being replaced at this time, the ADOC resuming full control on 1 September 1962.

On 21 September 1962 Exercise *Fallex 62* was carried out. This was designed to test on paper the whole of the higher-level of the NATO offensive and defensive structure. First came intelligence build-up, then ADOC went through various alerts (Simple Alert–Reinforced Alert–State Orange–State Scarlet). During these alerts the duty Air Defence Controller carried out his tasks, passing on synthetic air defence conditions, airfield states etc but then ADOC was synthetically destroyed by a 10 megaton weapon, thus ending Fighter Command's participation in the exercise, which finally concluded on 28 September.

No notice exercises and the usual routine exercises, plus the monitoring of Soviet aircraft approaching UK airspace, were all carried out on a regular basis throughout the 1960s and 1970s. Typically the month of June 1965 was an exciting month operationally as, apart from Exercise *Kingpin* which replaced the annual *Fallex* for that year and the usual routine exercises, the operations staff were 'kept on their toes' as a result of the increased number of Russian Zombies. There were also X-Raids which had penetrated Area 12 in association with a large-scale Russian Naval Exercise in the Norwegian Sea. The following exercises were carried out during the month:

- *Co-Op* 65/2 1 / 2 June
- *Groupex* 10 and 17 June
- *Trex* 15, 22 and 29 June
- *Kingpin* 65 22 June

Kingpin was designed to train the command in its hot-war role and over a ten-hour period it aimed to familiarise personnel of their duties just prior to, and during the early stages of a nuclear war. The simulation was carried out in two phases, Phase 1 (CPX) and Phase 2 (LIVEX).

During the exercise there were 58 targets from the north-east attacking on a broad front ranging from Scotland to East Anglia. Fighters made 89 sorties and recorded 57 splashes.

The following Practice Alerts and No Notice Exercises (messages) were carried out during the month:

- Wideawake 21 June
- All Channels 12, 15 and 27 June
- Foam Calls 11, 14, 16 and 18 June
- Cut Bait 22 June – a USAF Alert

A Comsec Warning (Soviet shipping armed with electronic detection equipment) was in force throughout the month with a marked increase in activity from the 26 June. From that date, vessels of varied types operated in HQ FC Comsec Area from Faeroes to North Sea. Two cruiser-led task forces operated in waters north of the area. These and the subjects of the Comsec Warning appeared to operate with flight-refuelled Badger 'C's.

A typical interception was as follows:

X-Raids 63, 64, 65, 66 and 67, 27 June 1965

- Tracks appeared 200 nm north-west Saxa Vord.
- 63, 65 and 66 headed south over the North Sea.
- 64 and 67 headed south-west toward the Icelandic Gap. Leuchars QRA ordered to 2 minutes, then fighters scrambled.
- X-Raid 63 intercepted and identified as a Badger. Same QRA intercepted X-Raid 65, also identified as a Badger, then returned to base.
- Second QRA from Leuchars intercepted X-Raid 66, identified it as a Badger and shadowed it for 14 minutes.
- X-Raids 64 and 67 proceeded south-west between Iceland and the Faroe Islands.
- X-Raid 64 was intercepted by Icelandic (USAF) based fighters and identified as a Badger. Both X-Raids turned north-east between Faroe Islands and Saxa Vord.
- Leconfield QRA was scrambled to intercept X-Raid 63, this target turned east then north and the fighter was then returned to base with no contact.[24]

In 1968 a major reorganisation of the RAF command structure took place; in this was the merger on 30 April of Fighter and Bomber Commands to form a new entity – Strike Command. Bentley Priory then became headquarters of 11 (Fighter) Group.

On 1 March 1971, Air Defence Operations Centre closed down and moved into the Strike Command Operations Centre at High Wycombe. The underground bunker was retained and maintained in a serviceable condition for use as a stand-by facility should the High Wycombe one be put out of action.

[24] AIR 29/3318

Chapter 6: Extensions: Design and Construction

6.1 Project 80774 DW (Air)

It is believed that sanction for extending the underground block was approved before March 1981,[25] the Project Manager being MR Sutton. This project and its design came from the Croydon office of Defence Works (Air) of the Property Services Agency. From around July 1982, the proposal had been handed over to the electrical and mechanical engineers, Donald Rudd & Partners for detailed design work of all cabling, ventilation, interior fittings, plant and equipment.

The main contractor for the first phase of construction is believed to be Balfour Beatty with Thorn EMI Building Services Ltd being responsible for the installation of internal plant, fittings, and for commissioning.

The project included the provision of a new building (Blg.86) with access through a secure entry system including blast resistant doors, decontamination of personnel, rest rooms and canteen. It also had external plant rooms, including air filtration, heat rejection, and stand-by facilities.

The 80 Wing HQ building (Blg.258) was adapted internally as a temporary ADOC operations room while the construction took place.

In order to make a start on its construction, two Uni-Seco huts (Blg.266 used as a rest room and the other as ADOC offices), and an incinerator were all removed. As far as the old underground building was concerned, the following demolition occurred:

- A covered way linking the former Fighter Command HQ (Blg.263) with the western entrance to the old operations block
- The above-ground portion of the western entrance including a length of corridor and two sets of stairs plus the corner section
- An FW3/24 pillbox which was located above the western entrance corridor
- The four above-ground plant inlet and exhaust vents and their tunnels
- The above ground portion of the eastern exit and a length of corridor and one set of stairs.

The interior of the old building was remodelled with the removal of sections of corridors as well as the creation of a completely new concrete first-floor slab over the eastern half of the building, which is at a lower level than the 1939 floor level. This is supported by four new columns and low-profile beams (running laterally) along the north exterior wall, and three along the south external wall plus a central set of four. Above this is a suspended floor and suspended ceilings to create new computer rooms and offices. The existing plant was replaced, the truncated eastern exit was rebuilt at above ground level, and the new air-lock fitted with blast-proof doors. The old building and part of the new extension was designated ‘clean side’ and the other part of the new extension was designated ‘dirty side’

[25] The earliest known drawings of Blg.86 are dated March and July 1981

The dirty side extension was provided with duplex air-intake and exhaust tunnels (air ducts) which were connected to the plant rooms by a labyrinth of air expansion chambers. The main access route was provided by a new road connecting to a plant inlet tunnel, while the main entrance to the clean side is to the east.

6.2 Construction

Building 86 is of monolithic concrete construction, the concrete specification was C30N (20 mm aggregate) mix and its basic construction design is similar to that of the original. The entrance block is separated from the underground part of Building 86 by a 20 mm movement gap, and the extended underground part is separated from the 1939 building by a similar gap. Exterior wall thickness of the extension is 1000 mm, except for the entrance block which is 1500 mm. The external underground part is faced on the outside with a band of 600 mm shingle which is encased within a Tarram fabric filter (to allow for water drainage from the shingle to the subsoil); this thickness reduces to 300 mm shingle over the roof section. The roof and floor are both 900 mm thick – the roof being 3000 mm below the burster slab and the floor sits on a 75 mm blinding concrete layer (profile course) with a polythene membrane. The void between the burster slab and the roof is filled with clay. Structural interior walls are 500 mm and 600 mm while partitions within the clean side are 100 mm block work (a mixture of breeze and concrete blocks).

The primary burster slab over the 1939 building was cut back by 1000 mm to expose the reinforcing and then extended along three sides, firstly by making good and then another 3000 mm to the same thickness as the original. The southern section over Building 86 was reduced in thickness from 1524 mm to 1000 mm to cover the new building. The secondary burster slab over the 1939 building was not extended and remains as-built.

6.3 Further Extensions

Building 86 was again extended by a project dated July 1993 which was completed around January 1996. This provided another Uniter room located between the 1939 construction and the 1982 extension, plus a supporting plant room located between the existing plant rooms and air duct 2. The 1982 burster slab was also extended to cover the new facilities. New external heat rejection facilities were provided consisting of the adaption of building 88, formerly a stand-by set house, as well as the construction of a new structure (building 262) which is a ground mounted cooling tower with earth banking protection.

The new plant room extension has a power supply from the building 85 plant room and contains the uninterruptible power supplies (UPS) for building 85, and low-pass electromagnetic pulse (EMP) filters. It also provides a self-contained support system for the Uniter which includes stand-by generator, water cooling, water circulation, pressurisation systems, and fuel storage. The air conditioning plant is located within the Uniter room and the UPS within an annexe adjacent to the Uniter. Both the new plant room and Uniter have EMS screening and the computer spaces are provided with low-pass EMP filters.

Plate 25: Entrance elevation

Plate 26: Blast door to main entrance

Plate 27: Entrance and stair case

Plate 28: Kriblok walling detail

Plate 29: Air Duct 3 with generator exhaust pipes

Plate 30: Plant entrance

Plate 31: Emergency exit

Plate 32: Air duct 2

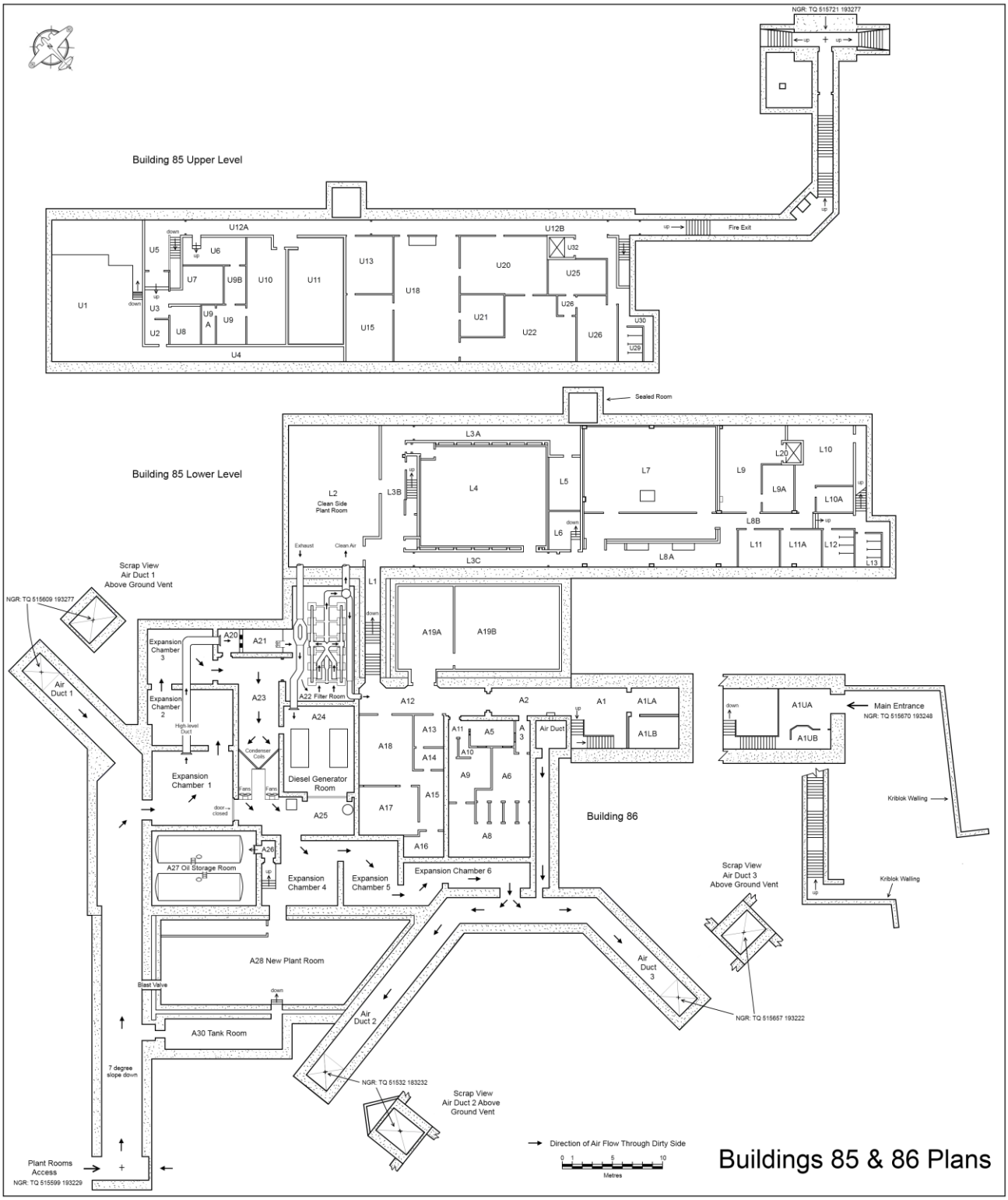


Plate 33: Plan – showing air flow through the dirty side

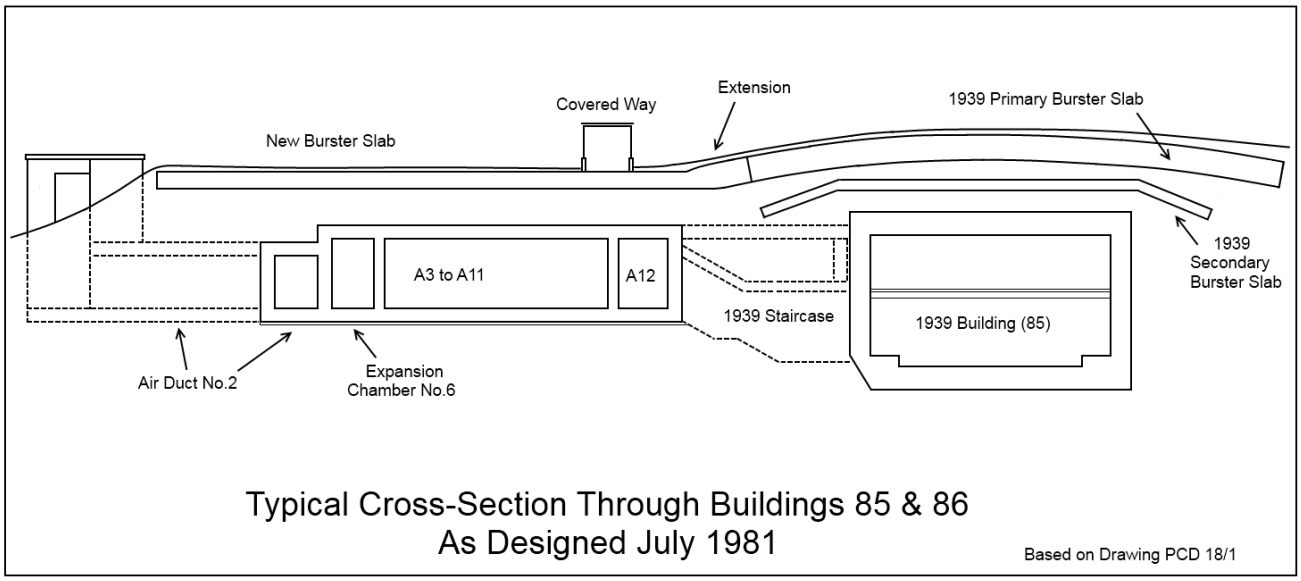


Plate 34: Cross-Section Sketch

Plate 35: A1 looking towards picket post and main entrance

Chapter 7: Room Descriptions

7.1 Introduction

Below is a room by room analysis of what survives today, alongside notes on the history of each room layout where known. Much of the internal plant ducting is hidden either above false ceilings or below suspended floors and while occasionally it is possible to view this, no attempt has been made to take down ceilings. Room dimensions have also been recorded, (dimensions within brackets are floor to ceiling heights). The descriptions make reference to the years 1939, 1982, 1990 and 1993; this is because most of the internal remodelling of the 1939 building and subsequent extensions were designed in 1982, 1990 and 1993. It is acknowledged that the actual reconstruction may have taken place in subsequent years.

7.2 Clean Side 1982 Extension (Building 86)

The above ground east–facing block is the main access to the clean side complex. It has a projecting concrete full width (length 3000 mm) weather canopy and below this is a single lockable steel blast door (2700 mm by 2130 mm and 0230 mm thick), having rubber seals and capstan locks. The entrance elevation is flanked on its east and south sides by Kriblok walling.[26] A new access road and car park was also built at this time.

The room numbering sequence (A1 to A18) follows in numerical order with only one number (A4), which is missing. A4 used to be A3 and A3 as designed in 1982 was the small air duct on the dirty side which used to be open to the clean side apart from rows of air guide vanes. Since then the air duct has been partly sealed up on the clean side south wall, except for a blast valve and exhaust trunking; the air-lock A4 was then renumbered A3. Therefore all room floor areas are as-built, except perhaps A1LB which has been created out of A1LA. The clean side part of the 1982 extension is primarily built of monolithic concrete finished in fair face concrete and painted walls, except for A13, A14, A15, A17 and A18 where internal walls are plastered breeze block and A3 which is painted concrete block. Floors are all screeded 50 mm concrete, either fitted with fire retardant carpet, ceramic floor tiles or two-part epoxy resin compound (A3, A6 to A11). Internal doors to rooms are mainly hardwood types with hardwood frames. Ceilings are all finished in fair face concrete and suspended ceilings where fitted are Dampa ST15 perforated 600 mm square tiles.

7.2.1 A1UA: Entrance Block (NGR: TQ 515670 193248 at entrance)

The entrance to A1UA is via an inner teak door with Chubb clasp. Inside, the floor area forms a landing overlooking A1 with steel railings and gates around its perimeter and is also the top of a stair well. Overhead is a Demag (3,200 kg) runway beam with block and tackle which projects

[26] The Kriblok system consists of reinforced precast concrete components specially designed to interlock with each other, it allows for the rapid construction of stable, attractive earth retention schemes without the need for mortar or special fixings. It consists of only two basic components, a header unit and a stretcher unit. It can be erected to form concave or convex radii as well as internal or external corners using standard components. On site, Kriblok units are simply assembled to create a series of interlocking cribs which are then filled with granular free draining material to provide a high performance gravity wall structure.

westwards into A1. When the block and tackle is in operation the gates around the perimeter of A1UA are opened. A horizontal red-coded dry riser outlet is positioned along the north wall. Walls, floor and ceiling are monolithic concrete. The east wall has a fire alarm repeater panel. The floor drop from A1UA to the floor of A1 is 2896 mm.

- Dimensions: 5109 mm By 5961 mm (includes A1UB) (3886 Mm)

7.2.2 A1UB: PICKET POST

A1UB forms part of A1UA – it is the front of house security office or picket post. It is of a timber framed construction, full height and clad with plasterboard. At the front there is a glazed bay window with pass slot. Access is either through a sliding door or through a conventional door off the landing. The floor and ceiling are monolithic concrete.

- Dimensions: 3847 mm by 2385 mm (3886 mm)

7.2.3 A1LA:PROPERTY SERVICE AGENCY PLAN ROOM

A1LA is located directly below A1UA, on the main floor level of the bunker; it is an open plan room with a partition wall separating it from A1LB. The floor and ceiling are concrete, while the north wall is concrete block with a pier at the entrance.

- Dimensions: 2533 mm by 4808 mm (3885 mm)

7.2.4 A1LB: PROPERTY SERVICE AGENCY STAFF ROOM

AL1B is part of AL1A, with a partition wall separating it from A1LA; it is an open plan room. The floor and ceiling are concrete as are the south and east walls.

- Dimensions: 3341 mm by 4796 mm (3885 mm)

7.2.5 A1: HALLWAY

A1 is an open plan hallway with stair case up to A1UA, which at low level, and leads into corridor A2. It has an overhead runway beam (originating from A1UA) and a horizontal dry riser along the north wall which connects with the inlet located on A1UA. Walls, floor and ceiling are monolithic concrete; but the ceiling has two different heights. A1 is separated from A2 by a 30mm expansion gap.

- Dimensions: 5821 mm by 6000 mm (3939 mm & 7459 mm)

7.2.6 A2: CORRIDOR

A1 becomes corridor A2 which runs in a westerly direction and finishes at the A2/A12 steel gas-proof doors. The only room accessed from A2 is the A3 air-lock. A2 is constructed of monolithic concrete. Above the entrance to the A3 airlock is a high level Brookway ventilation steel trunking at ceiling level. This enters A2 and continues along the ceiling until it is level with the dirty side air duct, which is behind the southern wall of A2, it then drops vertically almost to floor level where it goes through the wall and into the dirty side air duct. This exhausts ‘dirty’ air from air lock A3 and the decontamination room. At the western end of A2 is a steel 32mm thick knife-edge gas-proof

double door arrangement with a capstan locking system which gives large-load access to A12, but when operational this door would be closed, locked and sealed.

The technical area consists of all rooms after the double steel doors separating A2 / A12. With the A2 / A12 doors closed, personnel entering the underground block via the main entrance route A1UA / A1 would access the area via the route A1UA–A1–A2–A3–A6–A7–A8–A9–A10–A11–A12.

- Dimensions 7795 mm by 2801 mm (3939 mm)

7.2.7 A3: Air Lock

A3 is an air-lock (dirty side) and is accessed from A2; it is at right-angles to A2 and gives access to the changing cubicles (A7). The walls are painted concrete block with a glazed window from the security control room (A5). Heavy hardwood doors are at both ends of the air-lock. The next sequence of rooms is a one-way thoroughfare, beginning with A3 through to A11. The floor is now covered with carpet, plus there are two Fuller's earth sumps.

- Dimensions: 1488 mm by 3194 mm (3941mm)

7.2.8 A5: Security Control Room

A5 is an open-plan room with glazed viewing panels (manufactured by Chubb Security Installations Ltd) which oversee A3, A6, A9 and A11. One wall has a door access mimic / control panel, there is also a key safe. Floor, ceiling and walls are concrete.

- Dimensions: 4393 mm by 2583 mm (3958 mm)

7.2.9 A6: Store

A6 is an open plan area between A3 and A7; it originally had rows of alternate over-boot benches and over-boot storage cabinets, plus a rifle / machine-gun rack. It is constructed of monolithic concrete but has a glass panel to allow viewing from A5.

- Dimensions: 5516 mm by 3809 mm (3954 mm)

7.2.10 A7: Undress Cubicles

A7 is a row of four undressing cubicles with open ends – they originally had self-closing doors but these are missing (possibly stored in A15). They are not showers, but would have had Fuller's earth hand trays inside each cubicle. They are constructed with walls of concrete block. Note: Fuller's earth is used by military and civil emergency service personnel to decontaminate the clothing and equipment of soldiers and CBRN (Chemical Biological Radiological Nuclear) responders who have been contaminated with chemical agents.

- Dimensions: cubicle is 1290 mm by 1996 mm (3958 mm)

7.2.11 A8: Decontamination

The A7 cubicles open into A8 which is the decontamination area. It is an 'L'-shaped room and connects via double doors (missing) with A9. Just before A9 there were two Fuller's earth sumps

but these have been filled in. The other fittings, which were originally inside here, were rows of chemical / biological suit storage racks and these are also missing. Floor, walls and ceiling are concrete. A6–A8 is 10131 mm by 8396 mm.

- ▷ Dimensions: 8392 mm by 2913 mm and 5015 mm (3951 mm)

7.2.12 A9: Contamination Control

A9 was a storage area for type S6 respirators – it also contained a workbench for maintenance of the respirators, but all of these fittings are missing. Construction is monolithic concrete but with a glass panel to allow viewing from A5. Pair of air-locks (A10) form the next rooms.

- ▷ Dimensions: 4389 mm by 5391 mm (max) (3947 mm)

7.2.13 A10: Air Locks

A10 is a pair of air-locks (clean) with hardwood doors giving access to the rest of the complex via A11 / A12.

- ▷ Dimensions: 1919 mm by 1003 mm (3957 mm)

7.2.14 A11: Lobby

A11 is an exit lobby with a non knife-edge steel door having capstan locks, which separates A11 from A12. Floor and walls are concrete. There is an inspection window (Chubb) from A5 with a narrow slot, presumably for receiving keys from the key safe in A5.

- ▷ Dimensions: 2077 mm by 1679 mm (3959 mm)

7.2.15 A12: Corridor

This is a corridor located on the west side of A2; it gives room access to A11, A13, A18 and A19A and is connected with the L1 corridor / stairwell. It is constructed of monolithic concrete and has two different widths; the ceiling is suspended (with 600 mm square perforated tiles) and it is of two different heights. The length from the rear wall of A12 to rear wall of A1UB is 32165 mm (this is total interior length of the 1982 extension).

- ▷ Dimensions: 13182 mm by 2448 mm & 2789 mm (2297 & 2794 mm)

7.2.16 A13: Executive Suite

Access to A13 is from corridor A12 via a split hardwood door; it is an open plan executive suite room which is located south of A12. The walls are plastered breeze block and there is access from here to A14.

- ▷ Dimensions: 3095 mm by 3178 mm (2446 mm)

7.2.17 A14: Bedroom

A14 is accessed from A13 and A15 – it is an open-plan room south of A13, and its original function was a bedroom. Walls are plastered breeze block; the floor is concrete covered with carpet. The ceiling is suspended with perforated 600 mm square tiles.

- Dimensions: 3103 mm by 2379 m m (2442 mm)

7.2.18 A15: Catering Store

A15 is accessed from A14, A17 and A18. This room contains a large floor mounted circular water tank with heater; the ceiling has an extraction system. Access to A16 is only from A15. The floor is quarry tiles, walls and ceiling are concrete and / or plastered breeze blocks.

- Dimensions: 2578 mm by 4889 mm (3992 mm)

7.2.19 A16: Water Tank Room

A16 can only be accessed from A15. It is a water tank room and access is difficult owing to three huge cold water tanks, one of which feeds the water heater in A15. However its primary function is for fire-fighting purposes, serving fire hose outlets located at various sites around the building. It has overhead steel ventilation trunking and is constructed of concrete / plastered breeze blocks.

- Dimensions: 3342 mm by xx? (4039 mm)

7.2.20 A17: Kitchen

A17 is accessed from A15 and A18. It is a kitchen with a stainless steel hatch counter between it and A18. Surviving fittings include two stainless steel preparation areas and a double stainless steel sink. Missing fittings include a 'Dart' pressure steamer, servery counter, water boiler, automatic dishwasher and microwave ovens. The floor is quarry tiles, and the ceiling is suspended with 600 mm square perforated tiles. Underneath the floor are two fire-fighting booster pumps that serve the water tanks located in A16. Walls are a combination of concrete and plastered breeze blocks.

- Dimensions: 5900 mm by 4690 mm (2420 mm)

7.2.21 A18: Restroom

A18 is accessed from A12, A15 and A17. It functioned as a rest room, and is arranged open plan with stainless steel lined servery between it and kitchen (A17). The floor is concrete but there is an under floor room to a large waste water tank and two waste water discharge pumps. The floor is covered with carpet and the ceiling is suspended with perforated 600 mm square tiles, walls are concrete and plastered breeze block. There is a steam humidifier on a wall.

- Dimensions: 5397 mm by 7033 mm (2424 mm)

Plate 36: A1UB Picket Post

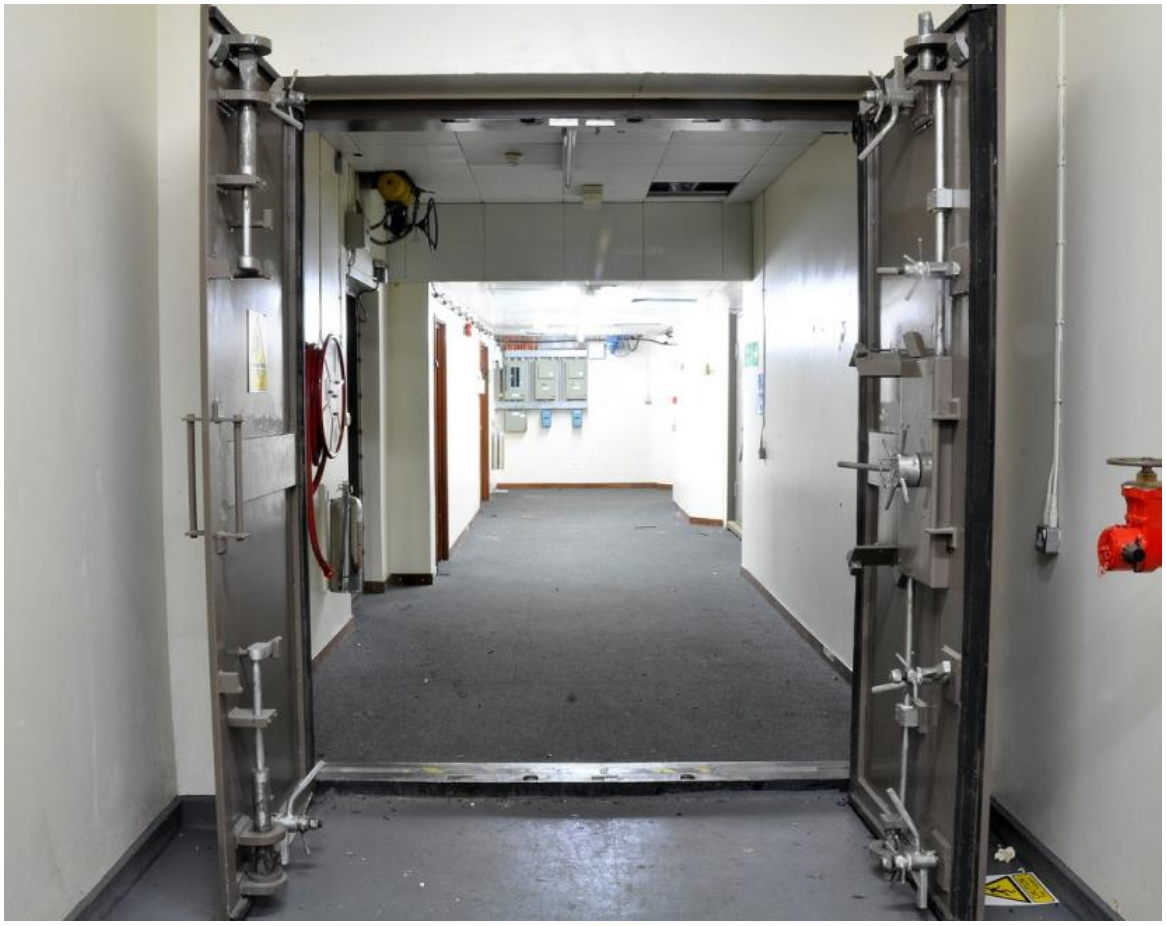


Plate 37: View looking from A2 to A12

Plate 38: A5 Security Control

Plate 39: View looking from A6 to A7 & A8

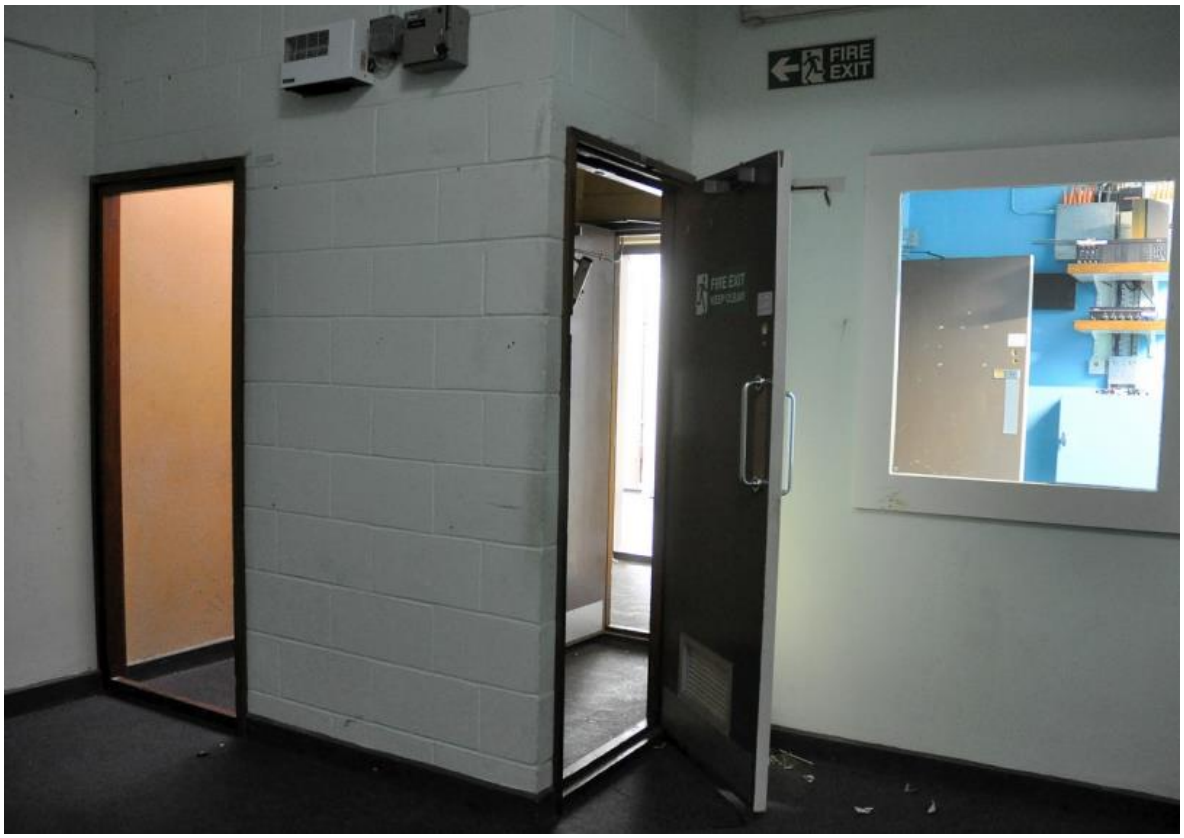


Plate 40: View looking from A9 to A10

Plate 41: A11 / A12 door

Plate 42: A12 / A2 door

Plate 43: A17 Kitchen

7.3 Clean Side 1993 Extension (Building 86)

Built between the 1939 operations block and the clean side extension is the 1993 extension which is in two main parts. Both A19A and A19B are hybrid enclosures lined with welded galvanised steel sheeting and plasterboard along all walls, 600 mm square floor tiles to both rooms plus a suspended ceiling in A119B, and exposed galvanised steel sheeting for A19A. The rooms were used as an EMP proof computer suite (A19B) with an adjacent small UPS unit (A19A). This was the new Uniter which replaced an earlier one, located within U11. Access is via a pair of double leaf knife-edge steel doors to A19A (the UPS room) while A19B is part of A19A.

7.3.1 A19A: UPS Room

A19A is accessed from corridor A12. It contains a bank of eight UPS battery modules along the north wall; there are also seven Liebert modules, a computer isolating switching module, three Liebert rectifier power supply modules, two Harmer & Simmons Ltd rectifier modules, isolator switching modules and two air conditioning distribution control panels.

- Dimensions: 5525 mm by 7033 mm (3661 mm)

7.3.2 A19B:Computer Room

Three aluminium steps give access to A19B from A19A. It is an open plan room with two Liebert air conditioning units. The floor is suspended with floor tiles and eight cooling grills which would have been below the computer units. The ceiling and walls are steel lined with ceiling tiles.

- Dimensions: 7943 mm by 10487 mm (2470 mm)

Plate 44: A19A

Plate 45: A19A door

Plate 46: A19B

7.4 1939 Operations Block, Clean Side Lower Level (Building 85)

The 1982 room numbering sequence followed a logical order, beginning with L1, through to L14 with all numbers accounted for. In 1990 the interior of the lower level was remodelled, thus losing some of the original rooms and gaining a few new ones. Original 1939 walls where they survive are monolithic concrete while new sections of corridor are plastered breeze block. New internal room dividing walls are timber stud walls clad with plaster board. The majority of ceilings are suspended, either with 200 mm wide full width metal planks (Dampa X3) along corridors, or 600 mm square perforated thin sheet panels (Dampa ST15), or 600 mm square chipboard panels with an Artex finish. The suspended ceilings also house grills, lighting units, and hide the ventilation trunking. Floors are either concrete, or based on the Propadek Raised Access Flooring system covered in carpet or quarry tiles, or other types of suspended modular floors. In most cases floor covering is fire retardant carpet or carpet tiles. Apart from air-locks which have Durasteel doors, internal doors are mainly hardwood with hardwood frames.

7.4.1 L1: Corridor

The L1 corridor is accessed from the A12 corridor – it is part of the original entrance corridor and runs north–south. It has two sets of steps going down (a drop of 9 ft 4 in), separated by a small landing, and then followed by another length of corridor. This low-level section has a drainage channel cut into the floor with cast-iron grating and the walls have a pair of vertical slots which are the location of a pair of door jambs for the air-lock doors, but these are now missing. There is a 30 mm expansion joint between the old (L1) and the new (A12) parts which separates the two buildings. The steps have both original handrails in situ. L1 terminates at a porch area which is also assumed to be original. Imperial measurements are 4 ft 10 in by 37 ft 11 in and the height of the ceiling is 12 ft. Both main walls were originally external, and both have been ‘thickened’. The floor, steps, walls and ceiling are monolithic concrete.

- Dimensions: 11550 mm by 1483 mm (3642 mm) (12ft)

7.4.2 L2: Clean Side Plant Room

L2 is the original 1939 plant room and although this is still its function, all the original equipment has been removed. Today it houses refrigeration plant including an Air Receiver Ltd unit with Ingersoll-Rand compressor, two Dunham–Bush duel circuit twin package chillers with condensers and associated control panels plus four Holden & Brook Ltd pumps. It also contains the bunker sub-station and a mechanical services switch board. Steel stairs give access to a mezzanine floor of steel plate / chequered plate (U1). All walls are concrete, the west and northern walls are external. The floor is quarry tiles. Imperial dimensions are 46 ft 5 in by 25 ft

- Dimensions: 14146 mm by 9110 mm (3782 mm)

7.4.3 L3A: Corridor

L3A is all that remains of the northern 1939 longitudinal corridor running east–west, it is presumed to be original but has been shortened to half its length – this took place after November 1983. It

also originally gave access to a projecting store room on the north external wall but this has been sealed off (it is possible to see where the door existed as the join between old and new concrete is cracked). L3A connects with corridor L3B at its western end (through a set of timber fire doors) and at the eastern end at L5. It is 4 ft 11 in wide except where it terminates at room L5 where it is wider. Construction is monolithic concrete but the ceiling is suspended based on the Dampa X3 metal plank system. The end of the corridor contains an Elton electric heater duct. Above the ceiling is the main ventilation trunking run from plant room L2 which serves all rooms and one wall has an electric cable tray along its length.

▷ Dimensions: 16986 mm (2250 mm)

7.4.4 L3B: CORRIDOR

L3B is a corridor running north–south with the plant room on the west side and a staircase plus a cupboard and air-lock access to L4 on the eastern side. The ceiling is suspended, and consists of Dampa X3 metal planks. It connects with the two longitudinal corridors L3A and L3C. The cupboard was originally (1982) another air-lock to L4, but before that this and the airlock were the original (1939) entrance porches to Room 2. The walls are concrete and are thought to be original.

7.4.5 L3C: CORRIDOR

L3C is part of the southern longitudinal corridor running east–west, its length is presumed to be original (1939) and connects with L3B at its western end and L8A at the eastern end. It also gives access to L4. It is 5 ft wide. Both walls are solid concrete, but the southern wall has been 'thickened' to create A19A and A19B. The ceiling is suspended, based on the Dampa metal plank system. Electric cable trays, line its length.

▷ Dimensions: 14582 mm door to door (2259 mm)

7.4.6 L4: COMPUTER ROOM

L4 is an EMP screened hybrid computer room. The hidden walls of this room are presumed to be original (1939), but are now lined in welded galvanised steel sheeting and chipboard boarding (1250 mm wide, full height wall boards and 600 square ceiling tiles with 24 lighting units). It is a large open-plan room. Entry is through Ray Proof shielded type air-locks with steel knife-edge doors via corridor L3B and L3C, but from L3C it is not possible to access L4 as the air-lock on this corridor can only be opened from inside L4 – this air-lock is only 800 mm wide. The room has eight Isovel International Ltd microprocessor control modules, a Chloride EDP 400 module, computer supply panels plus an alarm control panel. The suspended floor is a Propaflor raised modular arrangement covered in carpet tiles and has 20 floor grills. L4 occupies the site of the 1939 floor arrangement of Room 2 (defence teleprinter room) and Room 3 (GPO battery / GPO power); all walls are therefore original but are hidden inside modern studwork etc. The floor area of L4 is the same as it was in 1982, except that the floor is lower and an external air-lock (one of two) off corridor L3C is now blocked to create a walk in cupboard.

▷ Dimensions: 12560 mm by 9773 mm (2675 mm)

7.4.7 L5: COMPUTER STORE

L5 is accessed only from corridor L3A. It is an open-plan room with a wall-mounted BT control panel. The floor is covered in carpet and the ceiling is suspended with 600 square perforated tiles. Walls are solid, the dividing wall between L5 and L7 is original – it was part of the western wall of the 1939 Room 6 (operations room) which was where L7 is now, (L5 being one half of the 1939 room 4). L5 has a similar floor area as it was in 1982.

- ▷ Dimensions: 3145 mm by 4968 mm (3270 mm)

7.4.8 L6: BATTERY ROOM

L6 is only accessed from corridor L3C / L8A, and then via three steps down. It is an open plan room with heater ducting, a stainless steel sink and stainless steel eye-wash basin. The floor is quarry tile and the ceiling is concrete. The walls are solid, the dividing wall between L6 and L7, was part of the western wall of the 1939 Room 6 (operations room) which was where L7 is now, L6 being the southern half of the 1939 Room 4. The floor area of L6 is the same as it was in 1982.

- ▷ Dimensions: 3174 mm by 4035 mm (3279 mm)

7.4.9 L7: COMPUTER ROOM

L7 is a hybrid 'Tempest' screened enclosure that functioned as a computer room; it was remodelled in this form by Thorn EMI and sub-contractor Belling–Lee Intec Ltd in 1984. It is arranged open plan but with a recent steel partition running full width to create an 'ECPO booth'? The main room has two circuit-breaker units. The floor and ceiling are suspended to create the enclosure, floor covering is carpet tiles. Access is through double leaf knife-edge doors, both of these from corridor L8A. Room L7 is almost exactly where the 1939 Room 6 (operations room) used to be. The floor area of L7 is the same as it was in 1982.

- ▷ Dimensions: 11759 mm by 13144 mm (1849 mm)

7.4.10 L8A: CORRIDOR

L8A is the east–west corridor following on from L3C, with access to L6, L7 and cupboard L15, before connecting with corridor L8B. There are two Airdale air-conditioning units within the corridor. Walls are solid with three projecting wall piers at 22 ft centres (14 in by 22 in); these are along the southern external wall and support the original (1939) part of the first floor. Walls are solid, the southern one being an external wall and the northern definitely does not date from 1939, the ceiling is suspended, based on the Dampa X3 metal plank system.

- ▷ Dimensions: 18476 mm (door to wall) (2236 mm)

7.4.11 L8B: CORRIDOR

L8B is the other east–west corridor and follows on from L8A. It gives access to L9, and L10, L11 and L11A, after a series of three steps are L12, L13, L14 and staircase L10B. Walls are all solid but are thought to date from 1982. The ceiling is suspended based on the Dampa X3 metal plank system. L8B occupies part of the site of the 1939 Room 5 (filter room). Three of the 1982 concrete

pillars that support the new floor slab are located along this corridor, these are aligned along the south external wall.

- Dimensions: 14784 mm by 1468 mm (2246 mm and 2841 mm to concrete ceiling)

7.4.12 L9: Electronic Workshop

Accessed from corridor L8B, L9 is an 'L' shaped room with access to the hoist equipment shaft (L20 / U32). Walls are solid, except for those shared with L9A which are partitions; the northern one is an external wall. The ceiling is suspended and the timber floor is suspended on RSJs, covered in carpet. This room gives access to L9A, and a below floor well or room. The floor area of L9 is smaller than it was in 1982, as L9A has been added to the SE corner of L9. The hoist equipment shaft is presumed to have been built in 1982. L9 occupies the site of part of the 1939 Room 5 (filter room). There are two 1982 concrete pillars on the west wall.

- Dimensions: 8530 mm by 6087 mm (2839 mm)

7.4.13 L9A: Office

L9A is an open plan room, but is part of L9 from which it is accessed. Two walls inside L9 are partitions, and the other is solid – the ceiling is suspended. L9A did not exist in 1982. L9A occupies part of the site of the 1939 Room 5 (filter room).

- Dimensions: 3402 mm by 4447 mm (2838 mm)

7.4.14 L9: Basement

L9 basement is part of the 1939 floor of Room 6, the WWII filter room. It is accessed through three flush doors set into the floor, and consists of a 35 ft 6 in by 26 ft 6 in basement with its concrete floor level 5 ft 9 in below the L9 suspended floor. It is divided into two equal halves by a blue brick 9 in wall that supports the ends of RSJs that carry hardwood floor joists. The northern half contains a large fresh water tank and the brick foundations for the hoist and a hoist machinery house. The southern side contains waste water tanks and associated pumps. The concrete walls of the longer dimension are the foundations for the 1939 inner corridor walls.

- Dimensions: 10692 mm by 8085 mm (1768 mm)

7.4.15 L10: Office / Workshop

Accessed from corridor L8B, L10 is an 'L' shaped room with the rear of the lift shaft projecting into the room. All walls are solid except for the two which are also a part of L10A; the northern one is an external wall. The ceiling is suspended, the floor is carpeted.

- Dimensions: 5782 mm by 8531 mm (2202 mm)

7.3.16 L10A: Office

L10A is an open plan room, it is part of L10, two walls which are part of L10 are partitions, and the other is solid. The ceiling is suspended.

- Dimensions: 3605 mm by 2800 mm (2202 mm)

7.4.17 L10B: Store Room

L10B is located underneath the staircase U28 and is constructed with solid walls. It occupies the site of the 1939 lower level (eastern) north–south corridor and is not original.

- Dimensions: 0979 mm by 5782 mm

7.4.18 L11: Office

L11 is accessed from corridor L8B; it is an open plan room with solid walls apart from a dividing wall separating it from L11A – the southern wall is an external wall. The floor is presumed to be suspended, covered with carpet. The ceiling is suspended with perforated tiles. The floor plan of L11 is half that of the 1982 layout as L11A has been added to the eastern end of L11.

- Dimensions: 3906 mm by 4200 mm (2174 mm & 2833 mm)

7.4.19 L11A: Office

L11A is part of L11; it is an open-plan room with solid walls apart from a dividing wall separating it from L11. The room contains a concrete pier against the south external wall. The ceiling is suspended with perforated tiles. L11A was created out of part of L11 c.1990.

- Dimensions: 3913 mm by 3965 mm (2191 mm)

7.4.20 L12: Male Toilet

Accessed from corridor L8B where it rises by two steps is a male toilet. It contains three cubicles and two basins. All walls are solid, the southern one is an external, the floor is quarry tile and the ceiling is concrete. It is presumed to be original (1939). The floor plan of L12 is the same as it was in 1982.

- Dimensions: 3178 mm by 3909 mm (2309 mm)

7.4.21 L13: Female Toilet

Accessed from the higher level of corridor L8B, is a female toilet with four stainless steel sinks and four aluminium sheet toilet cubicles, the floor is quarry tile, walls and ceiling are concrete. The floor pan of L13 is the same as it was in 1982.

- Dimensions: 2785 mm by 3551 mm (2319 mm)

7.4.22 L14: Chemical Store

Accessed from the upper level of corridor L8B is a chemical sluice room. It is a narrow store-like room with quarry tile floor, concrete walls and ceiling. Fittings include a stainless steel sluice and a wall mounted Redring boiler. It is presumed to be original (1939).

- Dimensions: 0900 mm by 2021 mm (2941 mm)

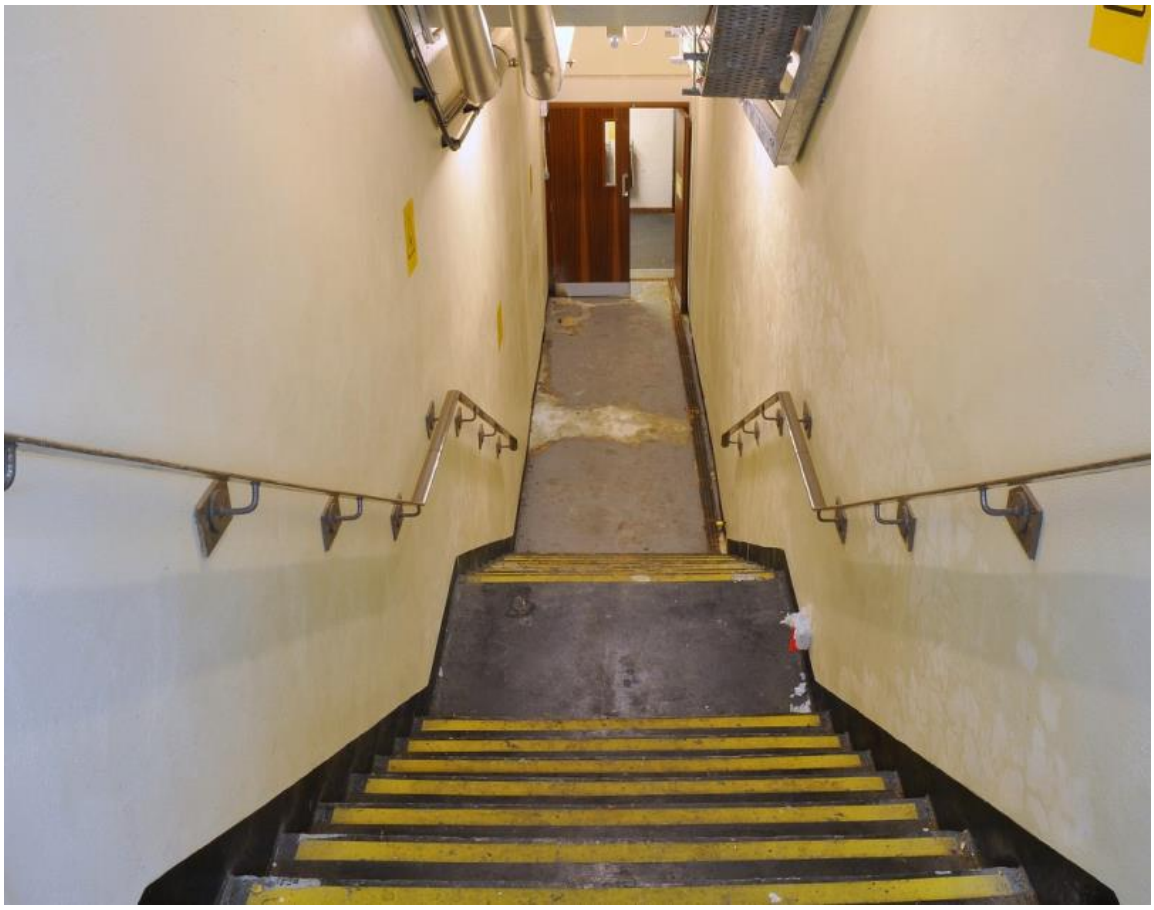


Plate 47: L1 corridor

Plate 48: L2 interior showing a chiller unit in the foreground

Plate 49: L3A corridor – view looking east

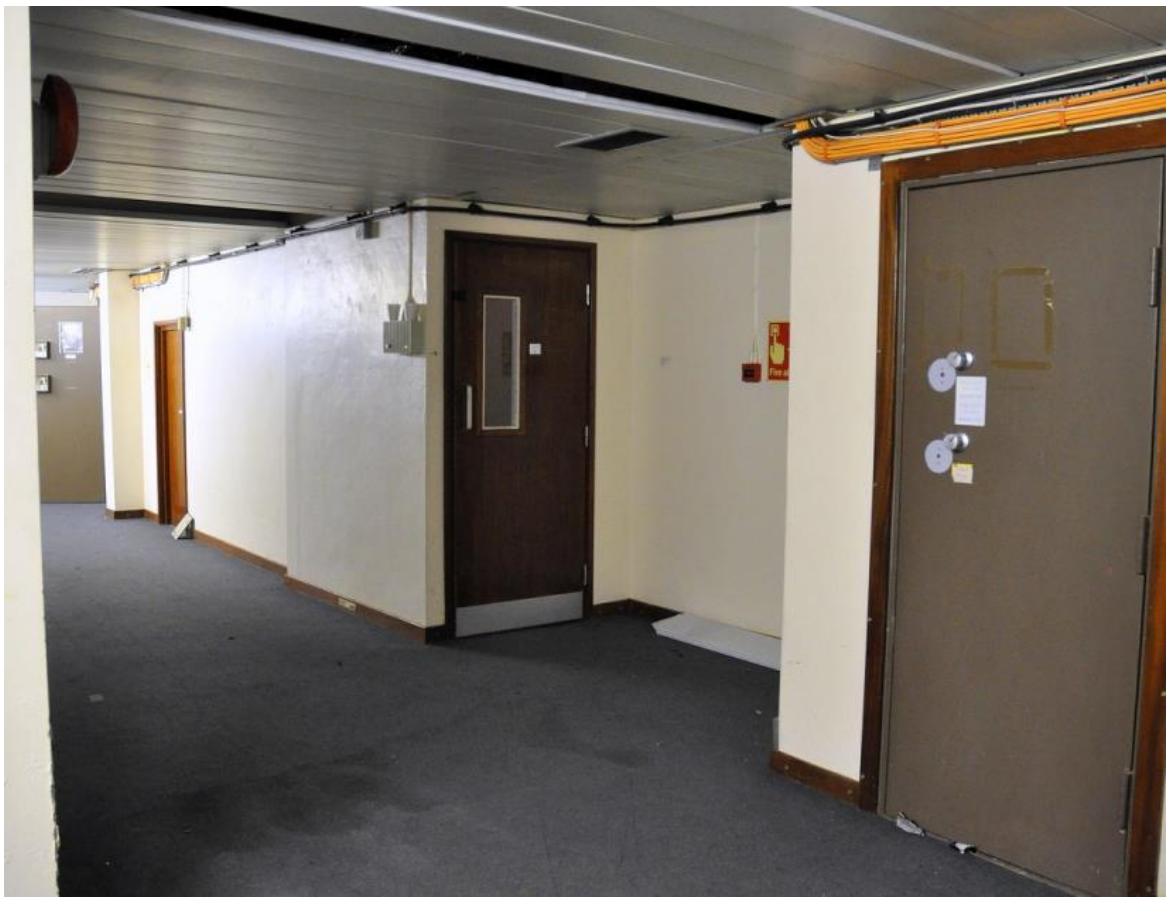


Plate 50: L3B – view looking at the original (1939) lobbies and stair case access routes

Plate 51: L3C corridor

Plate 52: L4

Plate 53: L7

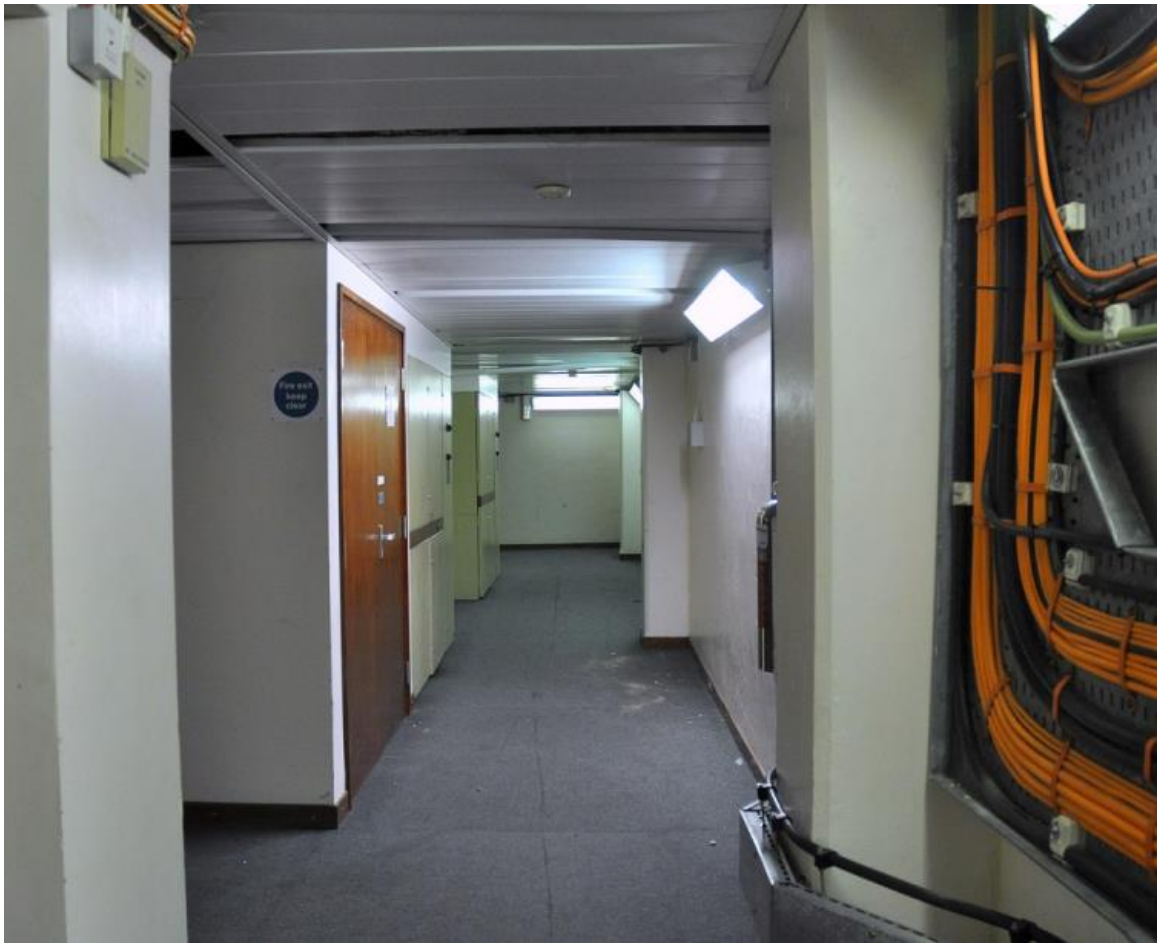


Plate 54: L8A corridor – note 1982 concrete pillars on right external wall

Plate 55: L9

Plate 56: L9 basement

7.5 1939 Operations Block, Clean Side Upper Level (Building 85)

The 1982 room numbering sequence followed a logical order, beginning with U1, through to U31, with all numbers in between allocated to a room but after a 1995 remodelling programme some numbers disappeared and others were created.

Original walls where they survive are monolithic concrete while new sections of corridor are plastered breeze block. New internal room dividing walls are timber stud walls clad with plaster board. The majority of ceilings are suspended, either with 200 mm wide full width metal planks (Dampa X3) along corridors, or 600 mm square perforated thin sheet panels (Dampa ST15). The suspended ceilings also house lighting and ventilation grills and hide the ventilation trunking. Floors are either, concrete, concrete and quarry tile, or based on the Propadek system, or other type of suspended modular floor. In most cases floor covering is fire retardant carpet or carpet tiles. Doors are either Durasteel or hardwood types with hardwood frames.

From the east side of U11, all rooms (U13, U15, U18, U20, U21, U22, U25, U26, U26A & U27) but not including U29 and U30, have been built above the 1982 concrete floor slab which is at a height of 2800 mm above the low level floor as opposed to the original which was at 3660 mm (12 ft).

7.5.1 U1: Clean Side Plant Room

U1 is the mezzanine floor above the plant room L2. It is similar in internal arrangement to the 1982 layout. The room has three air handling units Alair Ventilators (manufactured by Dalair Products Ltd) and a Keith Blackman Ltd 1000/289 fan unit (all plant installed c.1984). These are served by the main fresh air and extract ducts from the gas filter room (A22) in the dirty side and supplies filtered and cooled air to the clean side lower and upper levels. Note the imperial dimensions for L2/U1 are 46 ft 4 in by 29 ft 11 in by 22ft 2 in high.

- Dimensions: 14146 mm by 9110 mm (2892 mm)

7.5.2 U2: Office

U2 is a small square-shaped room between U3 and U8. Walls are solid, suspended ceiling (concrete exposed above) with ventilation grills and suspended floor (Propadek); doors are hardwood, it leads into U3 and corridor U4.

- Dimensions: 2427 mm by 2466 mm (2711 mm)

7.5.3 U3: Hallway

U3 is connected with U5 and appears to be an inner hallway, with walls on three sides; it provided access to U7, U8 and U2. One wall is solid and two are partitions. The suspended ceiling consists of Dampa X3 metal planks, the floor is suspended (Propadek) covered with carpet.

- Dimensions: 2416 mm by 4409 mm (2194 mm & 2440 mm)

7.5.4 U4: CORRIDOR

U4 is the southern longitudinal corridor, but in recent times it has only been used for storage. Construction is monolithic concrete and dates to 1939 although it only runs to half of its original length which is the same as it was in 1982.

7.5.5 U5: LANDING

U5 is a landing area, connecting corridor U12A to U3. On the eastern side are steel balustrades for the staircase down to L3B. The ceiling is suspended, with Dampa X3 metal planks. Walls are concrete.

7.5.6 U6: OFFICE

U6 is the radio room – it is accessed from corridor U12A, and there is an internal lobby with two steps down. There is also access to U9B. It is arranged open plan with solid wall, suspended floor (Propadek) and ceiling; the ceiling is vented and the floor is carpeted. The current floor area of U6 is the same as it was in 1982.

- Dimensions: 2879 mm by 6625 mm (2149 mm)

7.5.7 U7: BT FRAME ROOM

U7 has an internal porch and is accessed only from U3. All walls are solid except for the eastern one which is shared with U9B and this is a partition. The room is kitted out with five BT frames and a telephone exchange. The suspended floor is carpet on the Propadek system. The current floor area of U7 is smaller than it was in 1982 as lobby U9B has been built at the eastern end of U7.

- Dimensions: 3539 mm by 4507 mm (2158 mm)

7.5.8 U8: RADIO ROOM

U8 is only accessed from U3; it is an open plan room with a vented suspended ceiling and suspended floor covered in carpet. The floor area of U8 is smaller than it was in 1982, as U9A now occupies the eastern end of U8.

- Dimensions: 2945 mm by 3766 mm (2143 mm)

7.5.9 U9: OFFICE

U9 is an open plan room with suspended ceiling, and carpet covered floor. All walls are solid and may be original (1939). The door is wooden. The floor area of U9 is the same as it was in 1982.

- Dimensions: 2881 mm by 3984 mm (2143 mm)

7.5.10 U9A: OFFICE

U9A is part of U8 and can only be accessed from U9. All walls are solid except the dividing wall with U8. The ceiling and floor are suspended, the floor being a Propadek arrangement which is carpeted. In 1982 U9A did not exist as its floor area was part of U8.

- Dimensions: 3985 mm by 1742 mm (2153 mm)

7.5.11 U9B: OFFICE

U9B is surrounded on all four walls by other rooms, (U6, U7, U9 and U10), but access is only from U6 and U9. All walls are solid except for the dividing wall with U7 (as this room was part of U7 in 1982). The ceiling is vented and suspended and the floor is also suspended (presumed to be Propadek), covered with carpet.

- Dimensions: 1991 mm by 3540 mm (2151 mm)

7.5.12 U10: OPERATIONS COMPUTER ROOM

In 1982 room U10 functioned as the Communications Centre (COMMCEN) room. It is accessed from an external lobby off of corridor U12A. The lobby has an inspection window or hatch at the entrance. All walls are solid. It has a frequency interface filter unit and a fire alarm repeater panel. The floor area of U10 is the same as it was in 1982.

- Dimensions: 10653 mm by 3924 mm (2144 mm)

7.5.13 U11: OPERATIONS COMPUTER ROOM

U11 is accessed from an external lobby, off of corridor U12A, via a knife-edge steel door with Chubb lock. It is a hybrid type L3000 shielded enclosure with steel sheeting and plasterboard on all walls. The ceiling and floor are also suspended – the ceiling clad with 600 mm square tiles and the floor is presumed to be a modular arrangement. It is assumed that the walls are original although are now lined to create the original Uniter room in September 1983. The current floor area of U11 is the same as it was in 1982. The contractor for its current layout was Belling Lee Intec Ltd.

- Dimensions: 9816 mm by 5040 mm (2134 mm)

7.5.14 U12A / U12B: CORRIDOR

This is the upper level main longitudinal corridor and connects with U5 at the western end and the eastern staircase as well as the eastern (emergency) exit. U12A becomes U12B at a set of double fire doors about half way along the length of the building. The corridors are directly above the surviving portion of corridor L3A. The imperial measurement of U12A/U12B from the emergency exit to the L2 dividing wall is 164 feet. The distance from the corridor external wall to the southern external wall is 46 ft 4 in. This makes the operations block 164 ft by 46 ft 4 in (not including the plant room). The corridor over its entire length was present in 1982. It may have been in that year, that the small projecting room on the north external wall was bricked up. A vertical crack outline indicates where the door would have been. In 1982 the corridor was known only as U12. The ceiling is based on the Dampa X3 steel plank system. The northern wall is concrete (external) and although the corridor is believed to have been present in 1939, it is presumed that only the western half of the south wall dates to 1939, as the eastern end appears to be plastered breeze block and is built above a new concrete slab.

- Dimensions: 49998 mm by 14135 mm

7.5.15 U13: OFFICE

U13 is accessed from corridor U12A, there is also an internal door which allows access to U15. A borrowed light is part of the partition wall between U13 and U15. Two walls are partitions and the others are solid. The dividing wall between U13 and U11 is the 1939 west wall of the upper level of Room 6 (operations room). The ceiling is suspended and vented and the floor is also suspended and covered in carpet. The current floor area of U13 in 1982 was split between U13 and U14, plus a north-south corridor, providing access to both rooms.

- Dimensions: 4629 mm by 6028 mm (2273 mm)

7.5.16 U15: OFFICE

U15 is accessed from U13 and U18 – it is an open plan room. Two walls are solid, the dividing wall between U15 and U11 is the west wall of the upper level of the 1939 Room 6 (operations room). The others are partitions, one of the partition walls, shared with U13 has a borrowed light – the southern wall is an external wall. The ceiling is suspended and vented and the floor is suspended and covered in carpet. The current floor area of U15 was in 1982, shared with U15, U16 and U17 plus the same north-south corridor that served U13 and U14 (see U13 above).

- Dimensions: 4626 mm by 6307 mm (2268 mm)

7.5.17 U18: OPERATIONS ROOM

U18 is a large, mainly open-plan room with an Airdale air conditioning cupboard in the centre of the north wall, with an internal access lobby on either side from corridor U12B. It has a suspended ceiling and floor – floor covering is carpet and the ceiling is vented. The walls are solid except for the eastern one which is a stud wall; the southern one is a concrete external wall. Internal timber doors give access to U15, U20, U21 and U22. There is a floor-mounted (free-standing) master indication panel, with light indicators and switching for door warning lights, intruder detection, indication of foam discharge to oil tanks, fresh / dirty water fault lamps, electrical door-lock override, and diesel generator operating condition meters. There is also wall-mounted Tannoy unit and the master fire alarm control panel. The floor area of U18 has not changed since 1982, except the master indication panel has been moved to the east wall as the space was required for the air conditioning cupboard.

- Dimensions: 6719 mm by 12459 mm (2309 mm)

7.5.18 U20: CONFERENCE ROOM

U20 is accessed from corridor U12B; it is an open plan room between U18 and U25. Walls are mainly of a stud wall arrangement except for a solid section of the eastern wall which forms part of U32 (hoist). Floor and ceiling are suspended – the floor is covered in carpet and the ceiling is vented. When remodelled in 1982, the present floor area of U20 consisted of four small rooms, arranged as pairs, separated by a north–south corridor known as U19 / U20 (corridor), then U24 / U23. The current floor area of U20 dates from 1990.

- Dimensions: 8555 mm by 5848 mm (2379 mm)

7.5.19 U21: OFFICE

U21 is a square-shaped room, arranged open plan with a suspended and vented ceiling. Walls are solid with one exception which is dry-lined. Floor is suspended, covered in carpet. The only access is from U18. U21 is the same floor area as it was in 1982.

- Dimensions: 3883 mm by 3881 mm (2366 mm)

7.5.20 U22: OPERATIONS ROOM

U22 is accessed from U18, U20 and U26A, it has a 'T'-shaped plan-form with a mixture of stud and solid walls (the southern one is a concrete external wall). The floor and ceiling are suspended, the floor covering is carpet and the ceiling is vented. The floor area of U22 is the same as it was in 1982.

- Dimensions: 6526 mm by 11495 mm (maximum) (2258 mm)

7.5.21 U25: OPERATIONS COMPUTER ROOM

U25 is only accessed from lobby U26A, walls are mainly a stud arrangement except for part of the northern one which is solid as this is part of U32 (equipment lift). Floors and ceiling are suspended, the floor is covered in carpet and the ceiling is vented. This room was constructed as part of the 1982 remodelling. The floor area of U25 has not changed since 1982.

- Dimensions: 5831 mm by 3416 (2302 mm & 2962 mm)

7.5.22 U26: OPERATIONS COMPUTER ROOM

Access is from corridor U12B, internal access is to lobby U26A. Walls are mainly stud walls except for the southern one which is a concrete external wall. Floor and ceiling are both suspended, the floor covering is carpet and the ceiling is vented. Doors are all lockable Durasteel types – there is a wall-mounted Ray Proof EMP protection unit. The floor area of U26 is the same as it was in 1982.

- Dimensions: 6521 mm by 6522 mm (2287mm)

7.5.23 U26A: LOBBY

U26A is a lobby area serving U25, U26 and U22, through steel 'Ashford' doors fitted with 'Medway' lock sets, peep holes, and door handles. All walls are partitions, the ceiling and floor are suspended, and the floor covering is carpet. This lobby was constructed during the 1990 remodelling phase.

- Dimensions: 1904 mm by 1895 mm (2252 mm)

7.5.24 U28: CORRIDOR / STAIRS

U28 is the eastern staircase, constructed with solid walls and occupies the site of the upper level eastern corridor. It drops 11 ft 3 in and is not original.

7.5.25 U29: MALE TOILET

U29 is a toilet, with suspended ceiling, quarry tile floor, three cubicles, two urinals and two basins. Access is from corridor U12B. It is presumed to be original. The floor area of U29 is the same as it was in 1982.

- Dimensions: 3650 mm by 2497 mm (2366 mm)

7.5.26 U32: HOIST

U32 is the upper part of the service hoist; it was present in 1982 and is presumed to date from that year.

Plate 57: U1 plant room showing an air handling unit

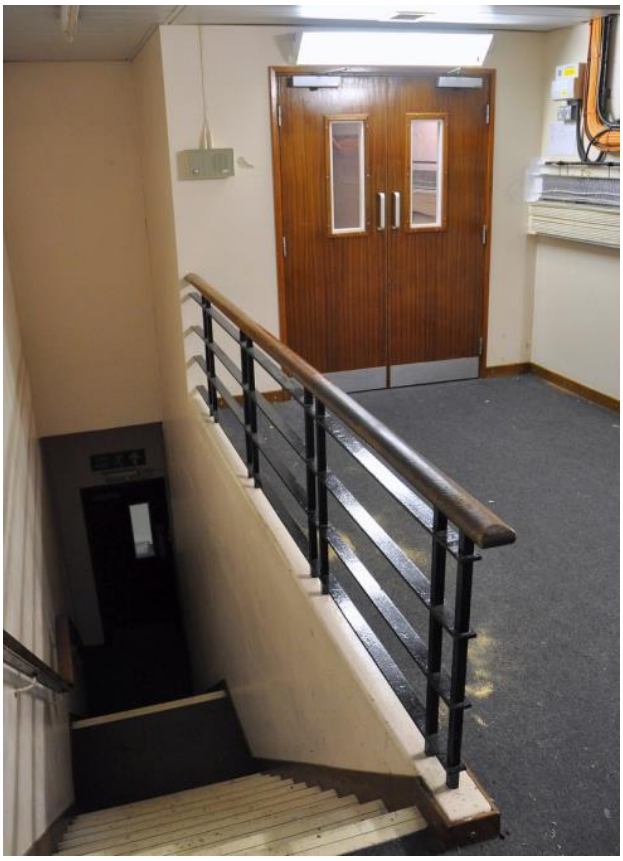


Plate 58: U5 landing

Plate 59: U7 BT frame room

Plate 60: U9

Plate 61: U10

Plate 62: U11

Plate 63: U12A corridor

Plates 64 & 65: U18 Operations Room

Plate 66: U26

Plate 67: U32 hoist

7.6 Emergency Exit (Upper Level Clean Side) (Building 85)

7.6.1 Escape Exit (NGR: TQ 515721 193277 centre of above ground path)

This consists of a nominal 5 ft wide corridor which exits the main building in an easterly direction before turning to the north. Along this part of the corridor is a set of eleven steps (rising 6 ft 10 in). This is 62 ft 4 in long, and at the eastern end is a 45 degree bend (11 ft 1 in long) which is 10 ft wide (to house a water tank) before the northern corridor. Here there are two ranges of steps, firstly a set of twelve (rising 7 ft 6 in), then another sixteen (rising 10 ft). This is followed by a horizontal section before an air-lock to exit the building. The length of this section is 39 ft 4 in. Before the airlock is a communications entry point. Only the first section and two flights of stairs are original (1939), the third set of stairs are missing and this part northwards dates from 1982 as does the above ground exit point and steps. Ceiling height is 9 ft 4 in.

- Dimensions: First length: 1535 mm by 19000 mm, 45 degree section 3384 mm, last section before the airlock 12000, followed by air lock 1506 by 4236 mm (2842 mm). Note all measurements taken from south and east walls.

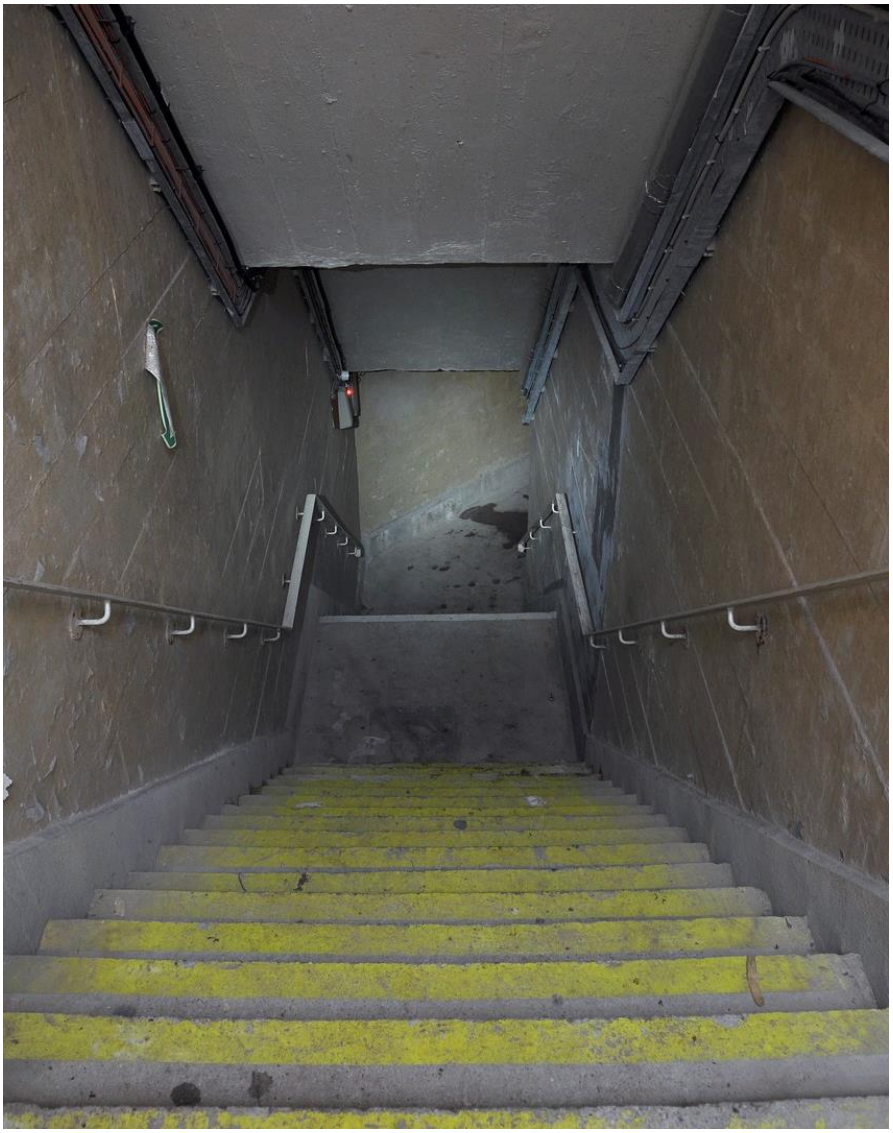


Plate 68: Fire exit

7.7 1983 Extension (Dirty Side) (Building 86)

The dirty side is constructed of monolithic concrete, the finish is rough (non fair-face) natural dark grey concrete to walls, ceiling and floor. During the survey there was very little in the way of electric lighting, apart from the odd room. The air quality is poor, being very dusty which is picked out by torch light and makes camera focusing very difficult. The attached above-ground structures are the concrete forms of air ducts 1, 2 and 3 and the plant access tunnel. There are two other plant related structures which are detached from Building 86, these being the two heat exchangers. It is not possible to access the dirty side from clean side, the only way in is through the plant access tunnel.

7.7.1 Plant Access Tunnel (NGR: TQ 515599 193229 – entrance centre)

Apart from emergency exits through the three main air ducts, this is the only access to the dirty side. It is a tunnel having a 7 degree slope down to the main underground floor level, and therefore gives access for personnel and plant. It is nominally square-shaped in cross-section, but its ceiling height is greater and wider at the low level end. Access is also possible from here to the new tank room A30 and expansion chamber 1. It becomes air duct 1 at its northern and low level end. Its other function was an additional air inlet duct. At the upper level there is a twin diesel 47/20 refuelling point serving oil tanks 7 and 8 (each with a capacity 52,000 litres) and tank 11 with a capacity of 80,000 litres. There is also a foam riser inlet point that serves the diesel tank rooms A27 and A30 for fire-fighting purposes.

- Dimensions: 3981 mm wide by 42872 mm to corner with air duct 1 (3070 mm at high level & 3985 mm at low level)

7.7.2 Air Duct 1 (NGR: TQ 515609 193277 – centre of above ground exit)

Air Duct 1 is a short length inlet conduit at the northern end of the plant access tunnel. It has three flights of stairs (emergency escape) and is the tallest of three similar structures, although this is the only inlet duct of the three main systems.

- Dimensions: 2495 mm by 14806 mm (max) (3000 mm & 10960 mm to roof of duct entry)

7.7.3 Air Duct 2 (NGR: TQ 51532 183232 – centre of above ground exit)

Air Duct 2 is the longest of the three main conduits and is an exhaust duct. It is now partially flooded. It has two flights of stairs (emergency exit). No.3 stand-by set exhaust pipe and silencer unit is located in air duct 2. It makes its way to join the cluster of exhaust pipes in air duct 3, where it terminates at the above ground outlet grill. Condenser water and generator pipe runs follow air duct 2, and leave the building underground in buried mains to terminate at heat exchanger No.1 – a distance of about 45 metres from air duct 2.

- Dimensions: 2510 mm by (8629 mm to roof at outlet)

7.7.4 Air Duct 3 (NGR: TQ 515657 193222 – centre of above ground exit)

Air Duct 3 is another exhaust tract; it has two flights of stairs (emergency exit). The three stand-by generator exhaust pipes are aligned along air duct 3, where they exhaust to atmosphere at the

above-ground duct outlet grill. Condenser water and generator cooling water pipes are routed here, but these leave the building as buried mains where they make their way to heat exchanger No.2 located in Building 88 – a distance of about 130 metres from air duct 3.

- Dimensions: 2495 mm by 14806 mm (max), (3000 mm & 8608 mm to roof at outlet)

7.7.5 AIR DUCT

This is a narrow tunnel and duct which exhausts dirty air originating from air lock A3 on the clean side. This air is drawn along the narrow duct and exhausted to atmosphere via air duct 3.

- Dimensions: 16439 mm by 1399 mm (tunnel) and 2900 mm by 2699 mm (duct) (4000 mm)

7.7.6 EXPANSION CHAMBER 1

Expansion chamber 1 is next to and south of expansion chamber 2. It is the first of the series of six expansion chambers, receiving air from air duct 1 and the plant access tunnel. It has two 2000 mm wide, full height wall openings. One leads to expansion chamber 1, the other has a steel door which gives access to A25 but when in operation this door would be closed. A high level 800 mm diameter low-velocity galvanised duct takes fresh air from here to fresh air chamber A20, where it then enters A21 and is heated by an electric heater – it then passes through a Vokes filter unit, after which it is pulled by fans into filter chamber A22.

- Dimensions: 7466 mm by 8084 mm (3977 mm)

7.7.7 EXPANSION CHAMBER 2

This is located between expansion chambers 3 and 1; it is an open plan room with two 2000 mm full height wall openings (north and south) on opposite corners. Air makes it way from air duct 1 and the plant access tunnel, to expansion chamber 1, then into expansion chamber 2.

- Dimensions: 8587 mm by 5409 mm (3995 mm)

7.7.8 EXPANSION CHAMBER 3

This is the northern most expansion chamber; it has open access from expansion chamber 2 and A23 via a 2000 mm wide full height wall openings. Air enters expansion chamber 3, it then takes a right-angled change in direction and continues through the cooling plant area A23.

- Dimensions: 5130 mm by 6503 mm (4020 mm)

7.7.9 EXPANSION CHAMBER 4

Expansion chamber 4 is located south of A25 and is next to expansion chamber 5. Air from the cooling plant area A23 enters A25 before entering expansion chamber 4 via a 2000 mm wide, full height wall opening where it is joined by exhaust air from an extract fan in kitchen A17. This air then enters expansion chamber 5 via another 2000 mm wide, full height gap in the wall.

- Dimensions: 7393 mm by 6501 mm (3976 mm)

7.7.10 EXPANSION CHAMBER 5

Expansion chamber 5 is between expansion chambers 4 and 6. From here the air enters expansion chamber 6.

▷ Dimensions: 5832 mm by 6500 mm (4006 mm)

7.7.11 EXPANSION CHAMBER 6

Expansion chamber 6 is the last one in the circuit. From here the air splits and a portion is exhausted through air duct 2 and the other is joined with bad air from the small air duct before exhausting through air duct 3.

▷ Dimensions: 12789 mm by 4231 mm (max) (3985 mm)

7.7.12 A20: FRESH AIR CHAMBER

Fresh air chamber A20 is a small square-shaped room in section (but full height); it receives fresh air from the high level low-velocity duct, before it makes its way through a set of vanes to enter A21.

▷ Dimensions: 2303 mm by 2288 mm (3973 mm)

7.7.13 A21: AIR FILTER ROOM

After the vanes in A20, the air passes through an Elton electric heater unit in A21 where it warms up before passing though Vokes bag filters. The clean filtered air is then pulled by a pair of Woods of Colchester fan units and enters the gas filter room A22. Construction of A21 is of concrete with steel framing supporting the heater, Vokes filters, and supporting framework for the fan units.

▷ Dimensions: fan room 2201 mm by 2291 mm (4006 mm) and heater room 0987 mm by 2294 mm (4000 mm)

7.7.14 A22: GAS FILTER ROOM

The filtering system had two main components – dirty and clean:

- Dirty: A high-level 700 mm diameter duct from plant room L2 takes dirty air through a plenum chamber and silencer unit – the air divides and goes through two 500 mm diameter ducts and increases in speed for its passage through various filters, it then slows down as it enters a single 800 mm diameter duct and is taken through a dividing wall to exhaust into A24 diesel generator room.
- Clean: Warm air from A20 / A21 is blown by two fans through 12 Sutcliffe Speakman air filter pack units into a plenum chamber arrangement (350, 300 and 200 mm diameter ducting) where the air is increased in speed still further and then distributed by high-velocity ductwork (500 mm diameter). Part of it is slowed down on its journey into Plant Room L2 (via 800 mm diameter ducting) the rest stays at constant speed on route out of the dirty side and into to the clean side (via 500 mm diameter ducting and a silencer). The filter pack units are mounted on wheels for ease of changing the filters.

▷ Dimensions: 2303 mm by 2288 mm (3973 mm)

7.7.15 A23: Cooling Plant Area

The air flow through expansion chamber 3 is drawn through the cooling plant area by two rows of (six) Engart 900 mm axial fans on the downstream side of a full-height (V-shaped in section) cooling matrix. This consists of two batteries of condenser coils (each of three sections) which is served by a pair of feed and return pipes from the clean plant room.

- Dimensions: 3970 mm by 11145 mm (max) (3991 mm)

7.7.16 A24: Diesel Generator Room

The diesel generator room contains two Cummins diesel engine sets (installed by Tilsey & Lovatt Ltd), a pair of high level diesel oil tanks, a load-control panel and a Markon Engineering AC generation 720 kVA control panel.

- Dimensions: 8306 mm by 7170 mm (3958 mm)

7.7.17 A25: Fan Room

A25 is partly used as the fan room behind the cooling plant A23 where there are two vertical banks of three 900 mm diameter Engart cooling fan units. There is also a Bearward Ltd radiator unit for cooling of the diesel engine sets, and a Hoval Farrar Ltd buffer pressure vessel.

- Dimensions: 4004 mm by 11654 mm (4000 mm)

7.7.18 A26: Lobby

A26 is a small lobby and provides access to the A27 oil tank room, the floor of which is 1257 mm below lobby floor height. It is accessed from a landing which is 1243 mm high from the main floor, via a steel stair. The landing is 1519 mm by 1631 mm (2753 mm).

- Dimensions: 1408 mm by 1811 mm (2769 mm)

7.7.19 A27: Oil Storage Room

A27 is an enclosed room just big enough to contain two 52,000 litre diesel oil tanks which serve via various valves, two oil tanks located close to the pair of diesel engine sets in A24. Access is from A26 via a steel fire-proof door and a vertical steel ladder.

- Dimensions: 10523 mm by 7603 mm (39994 mm)

Plates 69 & 70: A30 Tank room

Plates 71 & 72: Plant access

Plate 73: Air duct 2

Plate 74: A view looking towards air duct 2 from air duct 3

Plates 75 & 76: Expansion chamber 1 and door to A25

Plate 77: Expansion chamber 4

Plate 78: Expansion chamber 5

Plate 79: A21 showing a pair of fans

Plate 80: A22 Gas filter room

Plate 81: A23 Plant cooling area

Plate 82: A24 showing diesel generator (set No.1)

Plate 83: A view looking at A24 from A25 showing diesel generator (set No.2)

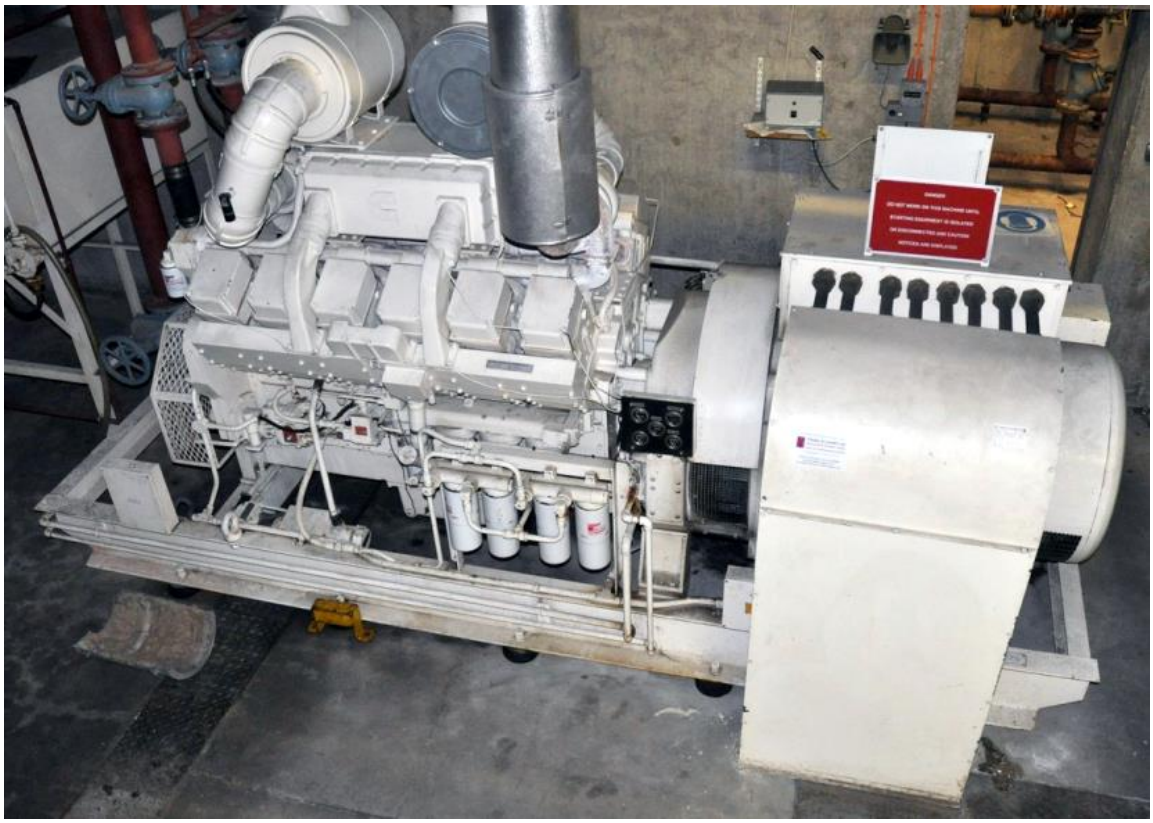


Plate 84: Diesel generator set (No.1)

Plate 85: A25 Engart cooling fan unit

7.8 Dirty Side Extensions (Building 86)

Designed in 1993 and built between 1994 and 1996 is the dirty side extensions, constructed in support of the new Uniter (A19A / A19B).

7.8.1 A28: Plant Room

The new plant room was constructed in the space between air duct 2, the plant access tunnel, the external wall of A27, and expansion chambers 4 and 5. The normal access route is through expansion chamber 4, via a 2000 mm wall opening and steel door.

It contains a pair of chillers with compressors (one is a stand-by) plus supporting control panel, a stand-by set (No.3 – manufactured by Auto Diesels and installed in 1995), along with supporting Stamford AC generation (910 kVA) control panel and a busbar unit. There are also three room-cooling units, an EMPP lobby, main switchboard, six Piller UPS modules, more battery pack modules, H&V control panel, a buffer tank, four pumps and two 10-bar Hydropress pressure vessels.

- Dimensions: 16800 mm and 24500 mm by 8200 mm

7.8.2 A28A EMP Protection Lobby

The EMPP Lobby is part of A26 – it forms the rear of the main switch board and busbar units. It is the location of a number of filter units, ranging from 30 A to 1,200 amp filters.

7.8.3 A30: Tank Room

The tank room is normally accessed through the upper part of the plant access tunnel; it is the floor above an underground 80,000 litre diesel fuel tank which supports the stand-by generator set in A28. It was constructed in 1994 and is separated from the plant room A28 by an air gap. A pedestrian access gap in the wall at the north-east corner allows access by vertical ladder to A28. At the steel ladder it is also possible to see the 500 mm wide air-gap that separates the tank room from A28 and the rest of Building 86.

- Dimensions: 11712 mm by 3043 mm (2091 mm)

Plate 86 & 87: A28 showing diesel generator and chiller unit

7.9 Heat Exchangers

7.9.1 Heat Exchanger 1(Building 262)

This is a below ground compound, constructed with Kriblok walling and houses a bank of eight fan-driven water condenser coolers. A pair of these is in support of the stand-by generators and the others are for A28 plant room. The pipes are in the form of a buried main, which exits building 86 via air duct 2.

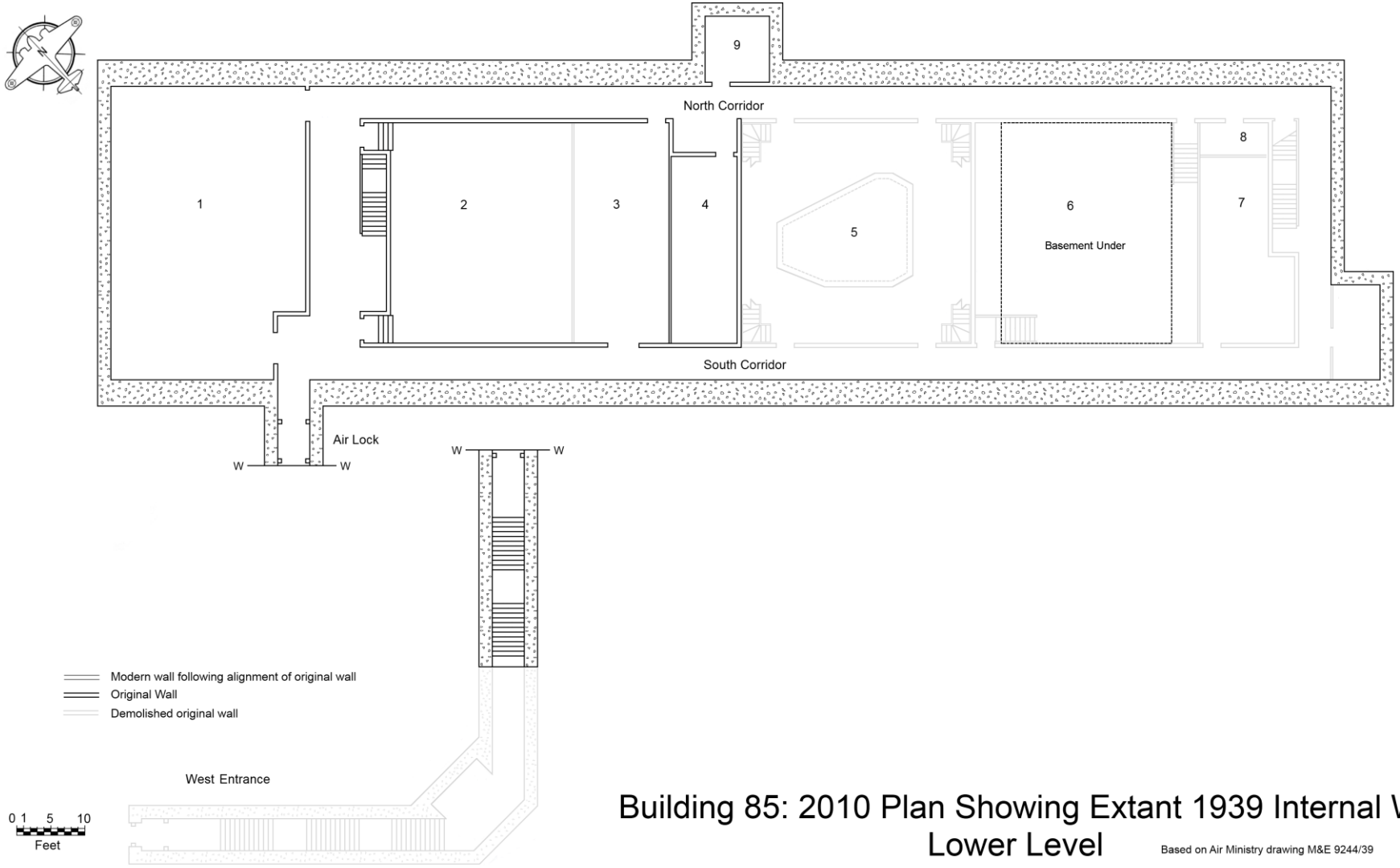
7.9.2 Heat Exchanger 2 (Building 88)

Building 88 is a pre-war stand-by set house, which was one of two, built in support of the underground operations block. It consists of a brick-built engine house with annexes for battery charging and a transformer room. This is surrounded by a concrete blast wall.

As heat exchanger 2, the main engine room has had large openings created out of part of the north, south and east external walls to allow cold air to be forced through the building. Two fan-driven water condensers cool the diesel generator cooling water which arrives at building 262 via a buried main from air duct 3.

Plate 88: Heat exchanger (Blg.262)

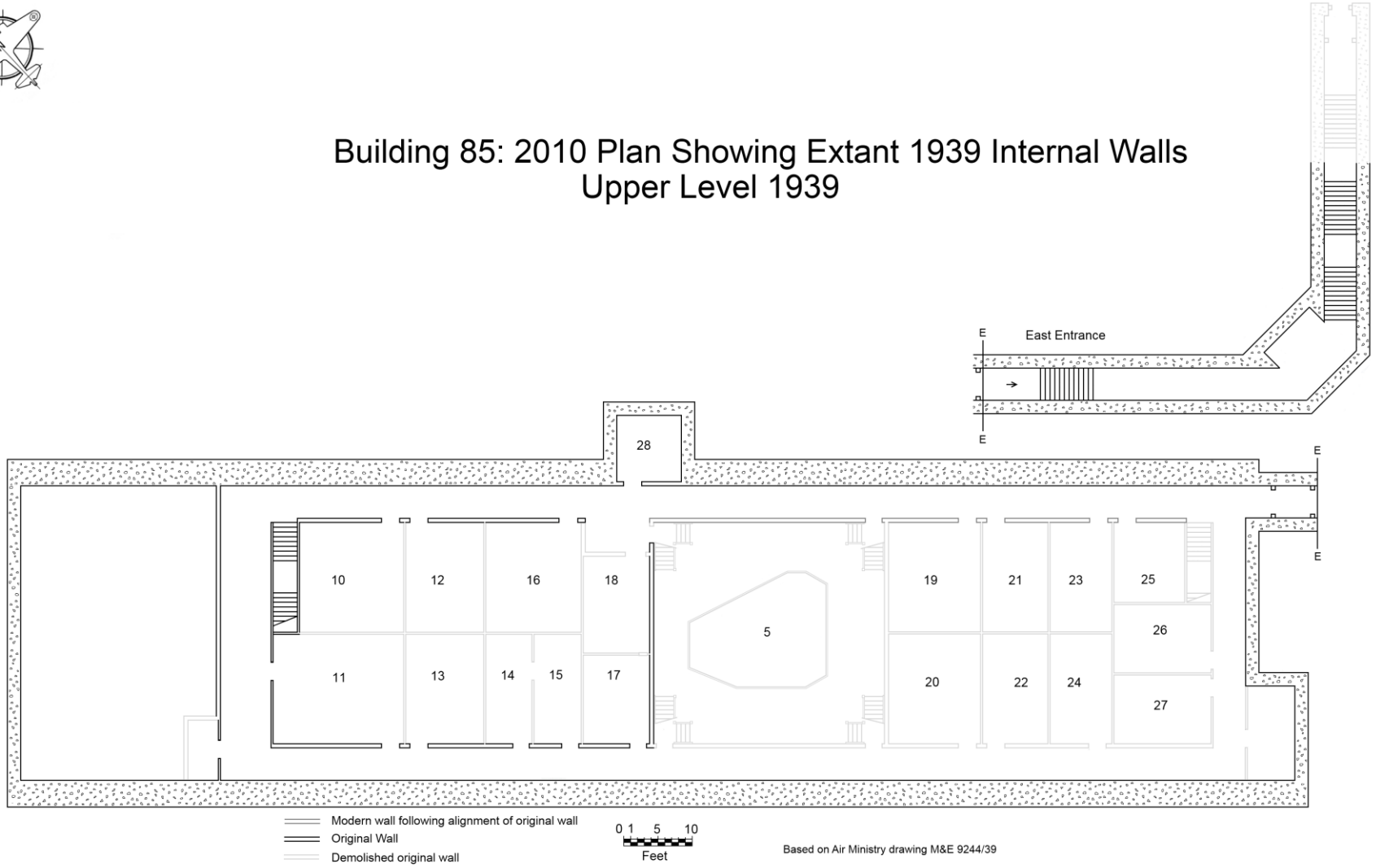
Over: Plates 89 & 90 Wall demolition drawings



Building 85: 2010 Plan Showing Extant 1939 Internal Walls Lower Level

Based on Air Ministry drawing M&E 9244/39

Building 85: 2010 Plan Showing Extant 1939 Internal Walls
Upper Level 1939



APPENDIX 1: 1939 UNDERGROUND OPERATIONS BLOCK – ROOM ANALYSIS

Room	Title	Corridor Access (N / S / E / W)	Wall Thickness (number)	Dimensions
Lower Level				
1	Plant Room	W	4 ft (three) & (9in (one)	46 ft 6 in by 35 ft
2	Defence Teleprinter Network	W	4.5 in (one) & 9 in (three)	35 ft by 27 ft 6 in
3	GPO Battery / Power	N & S	4.5 in (two) & 9 in (two)	35 ft by 15 ft
4	Rest Room	N	4.5 in (one) & 9 in (three)	30 ft by 10 ft
5	Operations Room	N & S	4.5 in (nil) & 9 in (four).	35 ft by 35 ft 6 in
6	Filter Room	N	4.5 in (one) & 9 in (three)	35 ft by 34 ft 6 in
7	Unknown ('L'-shaped room)	N & S	4.5 in (two) & 9 in (two)	30 ft by 11 ft & 15 ft
8	Unknown	N	4.5 in (two) & 9 in (two)	11 ft by 4ft 6in
9	Store	N	4.5 in (one) & 2 ft (three)	10 ft by 12 ft
N/A	Toilet	E	4.5 in (one), 2 ft (two) & 4 ft (one)	15 ft by 7 ft 2 in
Upper Level				
5	Operations Room (upper)	N & S	4.5 in (Nil) & 9 in (four)	35 ft by 35 ft 6 in
10	Unknown	N	4.5 in (three) & 9 in (one)	15 ft 6 in by 17 ft 3 in
11	Unknown	S & W	4.5 in (three) & 9 in (one)	19 ft 6 in by 17 ft 3 in
12	Unknown	N	4.5 in (three) & 9 in (one)	17 ft 3 in by 17 ft 3 in
13	Unknown	S	4.5 in (three) & 9 in (one)	12 ft 6 in by 17 ft 3 in
14	Codes & Ciphers	S	4.5 in (three) & 9 in (one)	7 ft by 17 ft 3 in
15	Codes & Ciphers	S	4.5 in (three) & 9 in (one)	7 ft by 17 ft 3 in
16	Unknown	N	4.5 in (two) & 9 in (two)	9 ft 9 in by 17 ft 3 in
17	Unknown	S	4.5 in (two) & 9 in (two)	10 ft by 14 ft 6 in
18	Unknown	N	4.5 in (two) & 9 in (two)	10 ft by 15 ft
19	Unknown	N	4.5 in (two) & 9 in (two)	14 ft 9 in by 17 ft 3 in
20	Unknown	S	4.5 in (two) & 9 in (two)	14 ft 6 in by 17 ft 3 in
21	Unknown	N	4.5 in (three) & 9 in (one)	10 ft by 17 ft 3 in
22	Unknown	S	4.5 in (three) & 9 in (one)	10 ft by 17 ft 3 in
23	Unknown	N	4.5 in (three) & 9 in (one)	9 ft 9 in by 17 ft 3 in
24	Unknown	S	4.5 in (three) & 9 in (one)	9 ft 9 in by 17 ft 3 in
25	Unknown	N	4.5 in (two) & 9 in (two)	11 ft by 12 ft 9 in
26	Unknown	E	4.5 in (four)	14 ft 9 in by 10 ft 6 in
27	Unknown	E	4.5 in (three) & 9 in (one)	14 ft 9 in by 10 ft 6 in
28	Toilet	E	4.5 in (one), 2 ft (two) & 4 ft (one)	15 ft by 7 ft 2 in
29	Kitchen	N	4.5 in (one) & 2 ft (three)	10 ft by 12 ft

APPENDIX 2: THE BIZARRE CASE OF THE BENTLEY MANOR ESTATE (MRS F DE L'ANSON-ANSON)

(Based on AIR 2/4400)

Mrs 'A' first became known to the Air Ministry in 1936, when she offered a crypt on her property for the purposes of underground accommodation. Later she heard that underground operations rooms were being built at Bentley Priory and she wrote through various influential persons claiming some reward for the idea which she said the Air Ministry had adopted.

At the same time, she offered the whole of her property for sale to the Air Ministry, but the offer was declined. The property at this time consisted of three portions:

- Bentley Manor, with 1 acre of land
- A bungalow known as '*The Bush'* with a barn and 3 to 4 acres of land
- A building site with main road frontage of 350 feet.

At the beginning of August 1939 the Signals Directorate required land near Bentley Priory for the erection of a pillbox for housing the change-over equipment for Post Office telephone cables in connection with the underground operations room. For this purpose a small plot of land was chosen on Mrs 'A's building site. The site was at that time offered up for sale with agents at £1,750. Mrs A offered it for £1,500, notifying the department privately at the same time that the Ministry of Health and a Mr Joyce were each separately interested in part of the property for hospital and hotel purposes respectively. Correspondence ensured on the basis of the offer and the matter appeared likely to reach some settlement with the Air Ministry (although the whole plot was not required for the pillbox), but then mobilisation intervened, followed by war.

On mobilisation the Army (Anti-aircraft Brigade) entered the house and its grounds and laid communications cables etc without notice. Army personnel were billeted in the grounds and by 1 September, a vast bulk of correspondence complaining about these activities had reached the Air Ministry, the War Office and Winston Churchill, demanding £1,250 compensation.

By 25 September the problem had further been compounded when it had been decided to take up part of her land for constructing the pillbox for the GPO switching scheme, and Mrs A was informed by letter on that date that under war-time conditions the property would be requisitioned although this procedure would not preclude sale. On receipt of this notice, Mrs A wrote directly to Sir Kingsley Wood, the Secretary of State for Air, protesting against the requisitioning part of her building site and stated that the property was practically sold to two different companies, and that the Air Ministry would be responsible for her loss of £10,300. Accordingly she refused to sign the requisition form and stated that she would hold the Air Ministry responsible for any loss involved.

Following this, 'she' bombarded the Air Ministry, Sir Kingsley Wood, HM The King, Neville Chamberlain, Captain Balfour, The Home Secretary, Winston Churchill and various MPs with letters, many of which detailed the '*Gestapo methods introduced into England by Sir Kingsley*

Wood'. It transpired in 1941 that the letters were in fact written by her cousin Professor A Scott of Edinburgh, who had also written to President Roosevelt under his own name about 'the problem'.

The problem was, that she had borrowed money from the bank to build two large wings to what was originally known as Bentley Priory Lodge (a three-roomed Tudor style dwelling) thus converting it into Bentley Manor. She paid £1,500 for the lodge, and then extended it to 15 rooms, and now the bank wanted some of the interest to be paid. Her only income was from breeding dogs and her pension, which was not enough to pay the bank and to live on.

The situation escalated even further from April 1941 because the WAAF mess located in a house called '*Barlogan*' had become hopelessly overcrowded and as the Air Ministry had already requisitioned almost every house in the locality, the only alternative was Bentley Manor! The requisition date was 9 July 1941.

Unfortunately it is not known what became of Mrs 'A', but by June 1947 Bentley Manor had been purchased by Philip Donald MacMillen. The land on which the pillbox stood was derequisitioned on 24 June 1949. Compensation was paid to PD Macmillan under the Compensation (Defence) Act 1939 of £2 per annum. It is understood that the pillbox was demolished between December 1948 and June 1949.

APPENDIX 3 DISPOSITION OF AIR FORCES 1942

No.9 Group (HQ Preston)	
Sector	*Sector Letter*
Andreas	PA
Woodvale	PB
Atcham	PC
Honiley	PD
Valley	PE

No.10 Group (HQ Box)	
Sector	*Sector Letter*
Middle Wallop	RA
Exeter	RB
Portreath	RC
Fairwood Common	RD
Colerne	RE

11 Group (HQ Uxbridge)	
Sector	*Sector Letter*
Tangmere	UA
Northolt	UB
Kenley	UC
Biggin Hill	UD
Hornchurch	UE
Debden	UF

12 Group (HQ Watnall)	
Sector	*Sector Letter*
Duxford	WA
Wittering	WB
Digby	WC
Kirton-in-Lindsey	WD
Church Fenton	WE
Coltishall	WF

13 Group (HQ Newcastle)	
Sector	*Sector Letter*
Catterick	NA
Ouston	NB
Turnhouse	NC
Ayr	ND

14 Group (HQ Inverness)	
Sector	*Sector Letter*
Dyce	IA
Tain	IB
Kirkwall	IC

82 Group (HQ Belfast)	
Sector	*Sector Letter*
St Angelo	BA
Ballyhalbert	BB
Eglinton	BC

APPENDIX 4: CONTROLLERS' TRAINING UNIT 1940 TO DECEMBER 1942 (BASED ON AIR 29/523)

The following is a summary taken from the unit ORB, written by the station commander. It covers the period June 1940 to 25 December 1942. It is unknown when the Controllers' Training Unit (CTU) closed down, but is presumed to have been in 1945.

The CTU was formed in June 1940 in the old operations room at Northolt and consisted of a lecture room, a sector operations block, a synthetic training room and an office. The staff consisted of four officers, two Sergeants, two Corporals and eight airmen.

On the 24 June 1940 the first nine officers reported for a two-week controllers' course. A total of 81 officers were trained on this course; at the same time 50 clerk special duties WAAF plotters were trained concurrently with the controllers.

The initial success of the school resulted in HQ FC requisitioning a house called '*Woodlands'*, at Clamp Hill, Stanmore. As the training commitments undertaken at *Woodlands* were on a far more ambitious scale, considerable equipment had to be installed and modifications carried out to the building and grounds. It was not until January of the following year that the school reopened.

At the same time the R/T speech unit at Uxbridge moved over to *Woodlands* and both units opened there on 5 January 1941.

The equipment at this time consisted of two operations rooms, a lecture room, a Ground Controlled Interception (GCI) synthetic trainer, plus four fighter and four bomber tricycles! Since then and before Christmas 1942 another two operations rooms were added, lecture rooms had been increased to four, an intermediate GCI trainer had been added and there were twelve synthetic training fighter tricycles fitted with four-channel VHF transmitters and receivers plus a Link trainer. The staff had increased to 12 officers and 113 other ranks. Another house '*The Dearne*', Uxbridge Road, Stanmore, had to be requisitioned and additional buildings erected to accommodate the increase in personnel and equipment.

The use of psychological tests for the selection of personnel as sector controllers, sector searchlight controllers and filter room officers etc, was developed in collaboration with Professor Bartlett and his staff of the Psychological Laboratory, Cambridge.

From the 5 of January 1941 until 25 December, the following courses were held:

- Sector Controllers: a three-week course plus ten to fourteen day shorter courses. Total of 882 personnel were trained.
- Controller Cadets: These consisted of specially selected NCOs and airmen who were to be tested and graded as to their suitability as sector controllers, before being recommended for commissioning. The length of this course varied from five days to three weeks. Total number trained 180.
- Deputy Controllers for NCOs and Airmen – a ten day course. Total number trained 625.

- Naval Fighter Direction Officers. There was no organisation within the Royal Navy for training fighter direction officers, either on aircraft carriers or catapult ships. Between April and July 1941, five courses were held in which 47 officers were trained. At the same time Naval personnel were trained and equipment loaned for a similar school to be set up at Yeovilton for the training of more personnel. A member of the controllers' training unit was also attached there to administer the interests of both Fighter and Coastal Commands.
- Flying Control Officers. Courses were held for officers who had undertaken training elsewhere, and had also to become proficient in Fighter Command application and procedure. 96 trained.
- Anti-Aircraft Liaison Officers. Certain specially selected Army officers were sent on controllers' courses in order to help them gain a better appreciation of RAF control problems. 12 personnel trained.
- Allied Officers. Special courses were held to give instruction in fighter sector operations room procedure and R/T. 15 personnel trained.
- Coastal Command Controllers. Two special three-week courses were held consisting of Fighter Command sector work with additional synthetic training in the use of long-range fighters and RDF interceptions.
- USN and Marine Air Corps. Individual instruction was given to US personnel in all problems pertaining to the operation of fighter aircraft. Course lasted three to four weeks. 9 personnel trained.
- GCI instructors. Only one course held, for 8 personnel.
- OTU Navigation Instructors. A five day course was held for specialist navigation officers from fighter operational training units to enable them to appreciate the problems which fighter pilots were faced with regarding navigation and fighter control. 8 personnel trained.
- Sector Searchlight Controllers. At the request of AA Command, two courses were held in which instruction was given on all aspects of fighter sector control and in particular in the employment of searchlights for interceptions. 50 personnel trained.
- Filter Officers. Six special courses were held in which filter officers were given practical problems in filtering and identification. 38 trained.
- US Army Air Corps. Officers and NCOs attended the sector or deputy controllers' courses. 20 trained.
- US Army Signals Corps (Electronic Group). Officers of this group attended the deputy controllers' course to gain an introduction to fighter sector work. 8 personnel trained.

The R/T speech unit had given instruction to all personnel attending courses and consisted of two, one-hour lectures – one on R/T procedure and the other on speech for R/T. In addition courses were provided in efficient speech for telephony or R/T intercom to the following:

- Tellers. 33 one-day courses between 14–04–41 and 11–08–42. 195 personnel trained
- Instructors from 25 Group (Air Gunnery Training). 11 three day courses between 05–01–42 and 17–03–42. 54 personnel trained.
- R/T Speech Instructors for Fighter Command OTUs. These officers had to train fighter pilots R/T procedure, give them instruction in efficient speech for R/T and run a dummy operations room. The course lasted four weeks. 12 personnel trained.
- Officers of the Royal Corps of Signals. 7 two-day courses were held between 28–06–42 and 12–08–42. These were designed to give instruction in efficient speech for R/T so that they could train Army R/T operators. Total number trained 33.

- Instructors and Signals Personnel from Bomber Command. 19 two-day courses were held since 17–07–42. Total number trained 55.
- Instructors from No.1 Signal School. 4 three-day courses for instructors concerned with the training of R/T operators were held between 19–11–42 and 25–12–42. Total number trained 10.

BP refers to Bentley Priory, SP is Stanmore Park.

AIR 2/1812	Operation rooms (Code B, 2/4): Fighter Command operations room: policy	1936–39
AIR 2/277	Purchase of BP Estate from Stanmore Estates Ltd.	1925–39
AIR 2/310	Sale of surplus land at BP, Stanmore, to C.G. Gordon Esq.	1927–28
AIR 2/337	Proposed sale of surplus land at BP, Stanmore to Mr. Pope.	1928
AIR 2/2997	New underground operations block, F Cmd, Stanmore: communications requirements	1938–44
AIR 2/3461	Personnel establishment of RDF filter room H.Q. Fighter Command	1938–41
AIR 2/4398–9	BP: application by adjoining owner for variation of restrictive covenants	1936–39
AIR 2/4400	BP underground communications: purchase from Mrs. F. de L'Anson–Anson	1939–52
AIR 2/13445	RAF Stanmore: acquisition and disposal of land and accommodation	1947–54
AIR 2/13998	RAF SP: sale of land	1947–68
AIR 2/16034	RAFBP: works services	1961–67
AIR 2/17664	*Montrose*, Stanmore: official residence for AOC–in–C Fighter Command, 1927	1959–62
AIR 2/18516	RAF SP	1968–69
AIR 2/18517	RAF SP	1969–73
AIR 2/19111	Future use of RAF BP, SP, Middlesex	1976–77
AIR 2/19145	RAF BP/SP organisation	1974–77
AIR 2/19205	Structural problems of RAFBP: alternative officers' mess accommodation.	1977
AIR 8/1512	Visit of HRH The Princess Elizabeth to Fighter Command, BP, 9 Nov.1950	1950
AIR 8/2821	Management of officers' messes; accommodation etc fire damage to RAFBP	1972–81
AIR 10/4054	Filter Room: Royal Air Force standing orders	1941
AIR 10/5554	Second World War 1939–1945: signals, telecommunications, organisation and development	1958
AIR 10/5556	Second World War 1939–1945: fighter control and interception	1952
AIR 10/5271	Second World War 1939–1945: Royal Air Force: Signals Vol IV radar in raid reporting	1950
AIR 16/343	R.D.F. filter room procedure	1939–43
AIR 16/408	The story of BP, Stanmore	1946
AIR 16/1100	Royal Air Force permanent exhibition at BP, Stanmore	1946
AIR 16/1241	HM The Queen's visit to RAF BP: fortieth anniversary dinner	1958
AIR 16/1242	HM The Queen's visit to RAF BP: provision of silver and pictures	1958
AIR 16/1507	RDF for the Filter Room: notes for talks to Filter Room personnel at Watnall	1941
AIR 19/476	Fighter Command: de–centralisation of filter rooms	1940
AIR 20/12750	Strike Command Works Services: development of RAFBP	1966–74
AIR 20/5239	Operations and filter room equipment	1942
AIR 20/7888	Land at *Glenthorn*, Stanmore, Middlesex: transfer to War Office	1956–59
AIR 23/721	Operations and filter rooms: policy	1939–42
AIR 23/5407	Mobile filter rooms: design and construction etc	1942–43
AIR 23/5604	No. 8 Sector Operations Room fighter control: Filter Room diary	1941
AIR 23/6263	Operations and filter rooms: organisation	1944
AIR 23/6725	Filter rooms: standing orders	1944
AIR 23/6856	V.I.P. tracks: filter room tracings	1944
AIR 28/2108	SP	1971–75
AIR 28/2258–9	RAF SP	1971–80

AIR 29/523	Controllers Training Unit, Stanmore	1940–44
AIR 29/2416	Air Defence Operations Centre, BP	1953–55
AIR 29/2610	Air Defence Operations Centre, BP	1956–60
AIR 29/2775	No. 3 Joint Services Trials Unit (JSTU), SP	1956–57
AIR 29/2880	Air Defence Notification Centre (South), BP	1956–58
AIR 29/3122	HQ, UK Air Traffic Service, BP	1959–60
AIR 29/3318	Air Defence Operations Centre (ADOC), BP	1961–65
AIR 29/3438	HQ Military Air Traffic Operations (HQ MATO), BP/Uxbridge	1961–65
AIR 29/3439–42	HQ MATO, BP/Uxbridge	1961–65
AIR 29/3566–6	HQ MATO, Stanmore/BP	1963–64
AIR 29/3952	Air Defence Operations Centre RAF BP	1966–70
AIR 37/1126	DCAS (AIR) SHAEF, AM ROBB: Notes of Commanders–in–Chief meetings at Stanmore	1944–45
AIR 51/16	Fighter operations and filter room	1944
AIR 51/35	Filter room instructions	1943–45
AIR 69/717	Programme for visit to HQ FC Operations Room, Filter room and CTS, Stanmore	1942
AIR 69/815	Programme for visit to HQ FC Operations Room, Filter room and CTS, Stanmore	1942
AIR 69/911	Programme for visit to HQ FC Operations Room, Filter room and CTS, Stanmore	1943
AVIA 7/167–8	Operations room: general	1938–40
AVIA 7/170–1	Operations room: apparatus	1938–40
AVIA 7/173	Operations room: experimental	1939–40
AVIA 7/174–5	Operations room: teleprinter	1939–40
AVIA 7/177–8	Operations rooms: Fighter Command	1938–40
AVIA 7/179	Operations rooms: Fighter Command HQ	1938–40
AVIA 7/180	Operations rooms: Fighter Group HQ	1939
AVIA 7/181	Operations rooms: Fighter Section HQ	1939–40
AVIA 7/183	Operations rooms: RDF filter rooms	1938–40
AVIA 7/184	Operations rooms: Observer Corps communications	1939–40
AVIA 7/185	Operations rooms: plotting and telling	1940–41
AVIA 7/370	RDF research at Stanmore: progress reports	1940
AVIA 7/438–43	RDF chain Stanmore: operational reports	1939–43
AVIA 7/532	RDF chain: operational reports by Stanmore research section	1940
AVIA 7/992	Operations room apparatus: table equipment	1940–43
AVIA 7/993	Operations room apparatus: indicators	1941
CAB 21/620	Demonstration of the new operations table at FC Headquarters, Stanmore	1937
CM 10/499	DCE2: BP	1974–80
CM 40/3–7	RAFBP: notes of meetings, correspondence relating to the extension to the officers mess and redevelopment of the priory; correspondence relating to fire at the priory	1979–83
CM 40/30	Feasibility study re proposed relocation of HQ 11 Gp support facilities from RAF SP to BP	1986–87
CM 40/37–59	RAFBP: feasibility study for the development of the old priory as an officers' mess	1975–81
DEFE 71/269	RAFBP: organisation	1977–79
DEFE 71/321	RAFBP: development of priory for use as officers' mess	1974–77
PREM 3/16	Filter rooms	1940
T 161/1397	Air Ministry: Headquarters of Fighter Command; accommodation at BP.	1938–39

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Signals: Volume V: Fighter Control & Interrogation (author unknown) HMSO 1952

Drawings

3238/39	Details of pipes in walls	1939
M&E 9244/39	Stanmore Type 2 Underground Building – electric light & power	1939
1392/50 (BP571)	RAF BP Record Site Plan	1950
M&E 945/54	Electrical Installation	1954
S1974/85	RAF BP Record Site Plan	1985
AB18/2	Lower Level Floor Plan December	1981
AB18/4	Ceiling Layouts Upper & Lower Floors January	1982
AB18/7	Layout of Kitchen and CCA December	1981
807774DW (Air)	Above Ground Layout of Extension March	1981
PCD 18/1 SADOC	Cross-Section of Wall Detail	July 1981
PCD 18/3 SADOC	Air Duct Outlets Details	July 1981
PCD 18/5 SADOC	Detail of Escape Staircase.	July 1981
PCL 18/3 SADOC	Floor Plan of New Bunker	July 1981
AM18/1	Finishes & Colours Schedule	Feb 1982
EB/18/1	Electrical Installation Lighting – Lower Level	April 1982
EL18/8	Heating & Ventilation equipment Location – Lower Level	July 1982
EL18/9	Heating & Ventilation Equipment Location – Upper Level	July 1982
EL18/10	Heating & Ventilating Equipment Location	July 1982
2285/A1/M2	Mechanical Services Layout – Upper Floor	01–Feb–85
64/40392/C/008	Raised Floors – Lower Level	07–11–95

64/40392/C/009	Raised Floors – Upper Level	07–11–95
64/40392/C/010	Suspended Ceilings – Lower Floor	07–11–95